

This electronic thesis or dissertation has been downloaded from the King's Research Portal at <https://kclpure.kcl.ac.uk/portal/>



**Protective factors for psychotic phenomena amongst children and adolescents exposed to multiple forms of victimisation**

Crush, Eloise

*Awarding institution:*  
King's College London

The copyright of this thesis rests with the author and no quotation from it or information derived from it may be published without proper acknowledgement.

**END USER LICENCE AGREEMENT**



**Unless another licence is stated on the immediately following page** this work is licensed

under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International

licence. <https://creativecommons.org/licenses/by-nc-nd/4.0/>

You are free to copy, distribute and transmit the work

Under the following conditions:

- Attribution: You must attribute the work in the manner specified by the author (but not in any way that suggests that they endorse you or your use of the work).
- Non Commercial: You may not use this work for commercial purposes.
- No Derivative Works - You may not alter, transform, or build upon this work.

Any of these conditions can be waived if you receive permission from the author. Your fair dealings and other rights are in no way affected by the above.

**Take down policy**

If you believe that this document breaches copyright please contact [librarypure@kcl.ac.uk](mailto:librarypure@kcl.ac.uk) providing details, and we will remove access to the work immediately and investigate your claim.

**Protective factors for psychotic phenomena amongst children  
and adolescents exposed to multiple forms of victimisation**

Eloise Crush

Social, Genetic and Developmental Psychiatry Centre,

Institute of Psychiatry, Psychology and Neuroscience,

**King's College London**

Submitted for the degree of Doctor of Philosophy

**2018**

## **Abstract**

Psychotic phenomena, such as hearing voices and being extremely paranoid, represent some of the most extraordinary and distressing mental states. Children and adolescents are significantly more likely to experience psychotic phenomena when they have been exposed to multiple forms of victimisation (poly-victimisation) although a substantial proportion of poly-victimised individuals will not develop these experiences. This thesis investigates why certain high-risk individuals do not develop psychotic phenomena in order to eventually inform early intervention efforts to prevent the emergence of psychotic phenomena among poly-victimised youth. Specifically, this thesis comprises four studies which investigate individual, family and community-level factors which are protective in relation to psychotic phenomena among poly-victimised children and adolescents. Analyses use data from the Environmental-Risk (E-Risk) Longitudinal Twin Study, a birth cohort of 2,232 twin children born in 1994 and 1995 in England and Wales. The first study investigates multi-level protective factors for age-12 psychotic phenomena among children exposed to poly-victimisation. The second study explores multi-level protective factors for age-18 psychotic experiences among poly-victimised adolescents. The third study considers gender differences in terms of the protective influences of social support on psychotic phenomena among poly-victimised adolescents. The fourth study utilises discordant twin methods to investigate whether the association between social support and the absence of adolescent psychotic experiences is environmentally mediated, after accounting for family-wide (including genetic) factors. Collectively, these studies identify multi-level protective factors for psychotic phenomena amongst poly-victimised youth, although these also appear to be associated with an absence of psychotic phenomena in this cohort regardless of poly-victimisation exposure. If replicated, these findings will have practical implications for interventions aiming to prevent the occurrence of early psychotic phenomena and the potential to prevent subsequent mental health problems.

## Table of Contents

<b>Abstract .....</b>	<b>2</b>
<b>List of Tables &amp; Figures .....</b>	<b>6</b>
<b>Acknowledgements .....</b>	<b>7</b>
<b>Declaration of authorship .....</b>	<b>8</b>
<b>Chapter 1: Introduction .....</b>	<b>9</b>
1.1 Background .....	9
1.2 Definition of research terms .....	10
1.2.1 Psychosis & psychotic phenomena .....	10
1.2.2 Poly-victimisation .....	14
1.2.3 Protective factors .....	15
1.3 Poly-victimisation & psychotic phenomena .....	17
1.4 Protective factors & psychotic phenomena .....	20
1.5 Thesis outline .....	23
1.6 Aims & Hypotheses .....	25
1.7 Power Calculations .....	26
<b>Chapter 2: Literature Review .....</b>	<b>28</b>
2.1 Introduction .....	28
2.2 Method .....	28
2.2.1 Literature search strategy .....	28
2.2.2 Inclusion criteria .....	29
2.2.3 Exclusion criteria .....	29
2.3 Results .....	30
2.3.1 Study selection .....	30
2.3.2 Study design .....	30
2.3.3 Assessment of psychotic phenomena .....	30
2.3.4 Measurement of victimisation exposure .....	31
2.3.5 Measurement of protective factors .....	32
2.3.6 Studies excluded from this review .....	38
2.4 Discussion .....	42
2.4.1 Methodological considerations .....	45
2.4.2 Conclusions .....	45
2.5 Distinct and original contribution to the field .....	46
<b>Chapter 3: Methodology .....</b>	<b>47</b>
3.1 Environmental Risk (E-Risk) Longitudinal Twin Study .....	47

3.2 Measures.....	49
3.2.1 Psychotic phenomena .....	49
3.2.2 Poly-victimisation.....	52
3.2.3 Childhood Protective Factors.....	58
3.2.4 Adolescent Protective Factors .....	61
3.2.5 Confounders.....	65
3.3 Statistical Analysis.....	66
<b>Chapter 4: Protective factors for psychotic symptoms among poly-victimised children ..</b>	<b>68</b>
4.1 Chapter 4: Supplementary Materials.....	79
<b>Chapter 5 (Part 1): Protective factors for psychotic experiences amongst adolescents exposed to multiple forms of victimisation .....</b>	<b>87</b>
5.1.1 Chapter 5 (Part 1): Supplementary Materials.....	95
<b>Chapter 5 (Part 2): Girls get by with a little help from their friends: Gender differences in protective effects of social support for psychotic phenomena amongst poly-victimised adolescents.....</b>	<b>102</b>
5.2.1 Chapter 5 (Part 2): Supplementary Methods.....	108
<b>Chapter 6: Using discordant twin methods to investigate an environmentally mediated pathway between social support and the reduced likelihood of adolescent psychotic experiences.....</b>	<b>116</b>
<b>Chapter 7: Discussion .....</b>	<b>129</b>
7.1 Summary of findings from empirical chapters.....	129
7.1.1 Are individual, family, and community-level factors associated with a reduced likelihood of psychotic symptoms among children exposed to multiple forms of victimisation? .....	129
7.1.2 Are individual, family, and community-level factors associated with a reduced likelihood of psychotic phenomena among adolescents in the general population and among individuals exposed to multiple forms of victimisation? .....	130
7.1.3 Are there gender differences in relation to the protective effects of social support in relation to psychotic phenomena among poly-victimised adolescents? ...	130
7.1.4. To what extent is the association between social support and psychotic phenomena environmentally mediated? .....	131
7.2 Discussion of main findings.....	131
7.2.1 Poly-victimisation and early psychotic phenomena during childhood and adolescence .....	131
7.2.2 Multi-level protective factors for psychotic symptoms during childhood.....	131
7.2.3 Multi-level protective factors for psychotic phenomena during adolescence ...	132
7.2.4 Gender differences, social support & adolescent psychotic phenomena .....	133
7.2.5 Environmentally mediated influences of social support in relation to adolescent psychotic phenomena.....	133

7.3 Limitations and methodological considerations .....	134
7.3.1 Cross-sectional analyses during adolescence .....	134
7.3.2 Social support was a subjective measure .....	135
7.3.3 Specificity of protective factors for psychotic phenomena .....	136
7.3.4 Timing and prevalence of poly-victimisation exposures.....	136
7.3.5 Psychotic experiences in adolescence were not clinically-verified .....	137
7.3.6 Sub-clinical psychotic phenomena are not psychotic disorders .....	137
7.3.7 General population versus poly-victimised groups .....	138
7.3.8 Potential protective factors not available in the E-Risk cohort .....	139
7.3.9 A sample of twins, not singletons .....	139
7.3.10 The majority of twins in the E-Risk cohort are White.....	140
7.4 Implications.....	140
7.5 Future directions.....	143
7.5.1 Further interrogation of the relationships between protective factors and psychotic phenomena.....	143
7.5.2 Consideration of the mechanisms underlying the association between protective factors and psychotic phenomena.....	144
7.5.3 Same factors protective for other high-risk groups.....	144
7.5.4 Other mental health outcomes.....	145
7.5.5 Considering protective factors for psychotic phenomena outcomes during adulthood.....	145
7.6 Conclusions .....	146
<b>References.....</b>	<b>147</b>

## List of Tables & Figures

### Tables

2.1 Overview of studies which met all inclusion criteria for literature review.....	35
2.2 Overview of studies which were excluded from this review on the basis they did not include a victimised sub-group in the design.....	40
4.1 Associations between potential protective factors and age-12 psychotic symptoms among children exposed to poly-victimisation.....	73
4.2 Associations between potential protective factors in childhood and age-12 psychotic symptoms in the full sample.....	74
5.1 Associations between individual, family, and community factors in adolescence and age-18 psychotic experiences in the full sample.....	91
5.2 Associations between potential protective factors and age-18 psychotic experiences amongst adolescents exposed to poly-victimization.....	91
5.3 Associations between social support and age-18 psychotic experiences amongst adolescents exposed to poly-victimisation, split by gender.....	105
6.1 Family-wide and unique environmental effects of social support on age-18 psychotic experiences.....	123
6.2 Family-wide and unique environmental effects of social support on age-18 psychotic experiences controlling for childhood mental health problems.....	125

### Figures

2.1 Flowchart detailing the selection process for articles included in this review.....	34
3.1 Stanford Brief Activity Survey Scoring Criteria.....	62

## Acknowledgements

I have been incredibly lucky to use data from the E-Risk Twin Study, which represents decades of work funded by the Medical Research Council as well as the Jacobs Foundation, National Institute of Child Health and Human Development, and British Academy. E-Risk was designed, created, and maintained by Professor Louise Arseneault and E-Risk founders Professors Terrie Moffitt and Avshalom Caspi; I would like to praise both your dedication and academic brilliance, which has allowed such an prized cohort to be created, thus leading to a vast array of important findings for the mental health field. Thank you also to the E-Risk families who, without their efforts, this research would not be possible.

I have many people to thank who have made my PhD possible and enjoyable. Firstly, thank you to Helen Fisher, you have been the most supportive supervisor on the planet; your dedication to your students and the wider field is inspiring and I am honoured to have worked together for the past 4 years. Thank you also to Louise Arseneault; your thoughtful input has been invaluable to my thesis and your commitment to team spirit has made me feel I was part of something in the E-Risk team – thank you. My PhD was funded by the Medical Research Council; thank you for the opportunity you have given me to be part of the highly esteemed Social, Genetic and Developmental Psychiatry Centre at King's College London – I hope I did you proud. Thank you to the SGDP Centre; you have been an intense yet brilliant place to be, surrounded by inspiring bright people has been something I will always carry with me. I have made great friends at the SGDP Centre; thank you to all you little geniuses who have been there over the years to talk about everything from twin modelling to holidays; particular thanks to Laura, Flo, Jo, Jessie, Sarah, Saskia and Natali for your friendship and support. A special thanks to Tim who suffered my endless questions and conversation, you have been an enormous source of help and support.

In the background I have received huge ongoing support from my parents, sister and her husband John; thank you for always being there for the highs and the lows of the PhD and for being the people I am most proud to share news of my publications with. Thank you to Charlotte who, from a young age gave me something to aspire to; I wouldn't be here without you. Anna and George, I hope I make you proud one day when you are big enough to read this; thank you for making me smile the past 4 years. Thank you to my best friend, Will Hamilton, for always believing in me and for your endless support. Finally, I will be forever grateful to Pete, for your problem solving, patience, love and positivity; thank you for keeping me relatively sane whilst I research psychosis.



## **Declaration of authorship**

I certify that the study planning, conceptualising, data analysis and writing in this thesis is my own original work. Two of the empirical chapters (Chapters 4 & 5) contain three published papers, and the contribution of co-authors to these papers has been acknowledged in the appropriate manner. Specifically, the final drafts of papers in this thesis were circulated to E-Risk co-authors and principal investigators prior to submitting to academic journals. Co-authors provided high level suggestions for amendments to the text or analyses, and I conducted these amendments where I felt these were appropriate. Furthermore, this thesis utilises data from the E-Risk Study which was collected by trained research workers over many years, and this is also acknowledged within the empirical chapters. In addition, variable construction was undertaken by E-Risk data managers, as were checks of the analyses in all empirical chapters. This thesis has not been submitted elsewhere towards any other degree. This thesis incorporates publications and I confirm that there is no infringement of copyright as all the journal papers included as Results Chapters have been made open access on the relevant publishers' websites via CC-BY licenses.

## Chapter 1: Introduction

### 1.1 Background

*“Although it is a waste of time to argue with a paranoid patient about his delusions, he may still be persuaded to keep them to himself, to repress them as far as possible and to forgo the aggressive action they might suggest, in general to conduct his life as if they did not exist.”*

The above quote was taken from a textbook which was influential among clinical psychologists during the 1950s (Mayer-Gross, Slater, & Roth, 1954, p.280). This snippet of text reveals how psychotic phenomena were historically perceived; as inconvenient, meaningless symptoms, only experienced by individuals with psychotic disorder. As the field progressed towards the end of the 20th century, clinicians and researchers discovered psychotic phenomena in the general population amongst individuals without psychotic disorder, and the realisation dawned that these phenomena were more common than originally thought (Cougnard et al., 2007; van Os, Linscott, Myin-Germeys, Delespaul, & Krabbendam, 2009). No longer dismissed as by-products of psychotic illness; in contemporary times researchers and clinicians proactively investigate psychotic phenomena, including extreme paranoia and hearing voices, amongst individuals in the general population. In the modern era which aspires towards preventative approaches, there is increasing consensus that psychotic phenomena may provide useful early warning signs during development of later mental health problems to come – and therefore constitute an ideal candidate for interventions looking to prevent the emergence of more severe mental health problems (Hanssen, Bijl, Vollebergh, & van Os, 2003; McGorry, Killackey, & Yung, 2008; Morrison et al., 2004).

Psychotic phenomena in the general population can occur at any point across the life-course, from early childhood into adulthood (van Os et al., 2009), though they tend to be more common in late childhood and adolescence (Kelleher et al., 2012a). Relatedly, these early developmental phases are now recognised in modern psychiatry as a critical time for meaningful early interventions as they typically represent the developmental phase prior to the emergence of more serious mental health issues (McGorry, Purcell, Goldstone, & Amminger, 2011). Research into psychotic phenomena has been able to establish factors which increase the risk for their development, such as exposure to childhood and adolescent victimisation and particularly multiple forms of victimisation, known as poly-victimisation. A notably scarce area of research concerns understanding why certain individuals do not

develop psychotic phenomena despite their exposure to significant risk factors. Investigating which individual, family and community-level factors may protect individuals from developing psychotic phenomena in the context of risk factors such as poly-victimisation has the potential to improve interventions and thus outcomes for future generations of vulnerable people.

## **1.2 Definition of research terms**

### **1.2.1 Psychosis & psychotic phenomena**

*“Psychosis is the price we pay for being what we are. And how unfair, how bitterly unfair it is that the price is not shared around but paid by one man in a hundred for the other ninety-nine.”*

Quote from Human Traces (Faulks, 2006, p.659)

Psychosis is the umbrella term for a range of psychiatric disorders which share common features including hallucinations, delusions, and thought disorder. As the above quote suggests, it is a relatively rare mental health condition with a prevalence of around 1% in the general population (Chang et al., 2018; Kendler, Gallagher, Abelson, & Kessler, 1996; Perala et al., 2007). According to the latest International Classification of Diseases (ICD-11; World Health Organization [WHO], 2018), there are a total of five diagnoses that fall within the primary psychotic disorder category: schizophrenia, schizoaffective disorder, schizotypal disorder, acute and transient psychotic disorder, and symptomatic manifestations of primary psychotic disorder. All psychotic disorders are characterised by significant personal distress, social disability, and need for care (Kirkbride et al., 2012).

Hallucinations and delusions are the hallmark symptoms of psychosis and are also referred to as positive psychotic symptoms. Hallucinations typically comprise seeing or hearing things that others do not (for example, hearing voices), and delusions are false beliefs which are not amenable to change in light of conflicting evidence (for example, paranoid thoughts). Thought disorder is another common positive symptom which refers to disorganised thinking and is typically evidenced by disorganised speech. Positive psychotic symptoms are differentiated from negative psychotic symptoms which reflect the absence of normal functioning including apathy (lack of motivation) and anhedonia (diminished ability to experience pleasure). Psychotic disorders are heterogenous in nature and therefore

whilst there will be common symptoms across individuals with the same or related psychotic disorders, the manifestation can vary significantly for individuals.

As alluded to earlier, traditionally psychotic phenomena have only been thought of as being associated with psychotic disorders such as schizophrenia. However, over recent years extensive epidemiological evidence has accumulated which highlights the presence of these phenomena in the general population, with prevalence rates higher than for psychotic disorders ranging from 5% up to 30% (Cougnard et al., 2007; Kendler, Gallagher, Abelson, & Kessler, 1996; van Os, Linscott, Myin-Germeys, Delespaul, & Krabbendam, 2009). Psychotic symptoms tend to be more common during early life than in adulthood, with a meta-analysis suggesting the prevalence of psychotic symptoms among children and adolescents to be around 20% and 7.5% respectively (Kelleher et al., 2012a). The presence of these symptoms in a larger proportion of the population suggests these phenomena are not only expressions of extreme psychotic disorders, but perhaps provide an early warning sign for the presence of less severe mental health issues, or potentially for the future development of more serious mental health problems among a subset of the general population.

The presence of psychotic phenomena in non-clinical populations are often referred to as psychotic experiences or symptoms, with prevalence rates of 8% and 4%, respectively reported across life course (van Os et al., 2009). Whilst there is inconsistency surrounding terminology of sub-clinical psychotic phenomena, some distinctions are emphasised within the current literature. Psychotic *experiences* typically refer to sub-threshold forms of hallucinations and delusions and include bizarre or unusual experiences. Psychotic *symptoms* are more extreme phenomena, which have reached a clinically-relevant threshold and tend to include higher levels of distress without any of the additional criteria necessary to meet a diagnosis of psychotic disorder (van Os et al., 2009). That said, empirical studies tend to use these terms in a variety of ways and therefore a meaningful distinction between these is not always possible within the literature. This thesis considers both psychotic symptoms (which have been clinically verified) and psychotic experiences (based on unverified self-report) in the data chapters and will also refer to these collectively using the umbrella term *psychotic phenomena*.

The discovery of psychotic phenomena in the general population has influenced modern theories of psychosis. Dominant theories propose psychotic disorders represent the extreme end of a phenotypic continuum, with expressions of psychosis becoming less severe as one moves down the continuum through psychotic symptoms and then psychotic

experiences (van Os et al., 2009; Verdoux & van Os, 2002). Continuum models have been supported by evidence that both phenotypic and aetiological consistencies have been found between psychotic phenomena in the general population and psychotic disorders (Polanczyk et al., 2010; Zavos et al., 2014). A key assumption of the continuum model of psychosis is that the presence of psychotic phenomena does not necessarily mean the presence, or eventual presence, of clinically-relevant psychosis (van Os et al., 2009). For many individuals, these experiences will be transitory in nature and only for a minority of individuals will these persist; it has been suggested that amongst individuals who experience psychotic symptoms in childhood, these will remit for approximately 80% during adolescence (Linscott & van Os, 2013; Zammit et al., 2013a). Whether these symptoms eventually escalate to clinical disorder has been proposed to be related to a number of factors linked to the experiences themselves (for example, intrusiveness, frequency, severity and any comorbid psychopathology) as well as other individual, family and community-level factors – including both risk and protective factors (van Os et al., 2009). Notably, psychotic phenomena in the general population have also been suggested to lie on a continuum with other psychiatric disorders (Fisher et al., 2013a; Poulton et al., 2000).

It is widely accepted that both genetic and environmental factors play an aetiological role in the development of psychosis. Twin studies have suggested that genetic influences account for up to 80% of the variance in psychotic disorders (Cardno & Gottesman, 2000) and between 15% to 60% of the variance in psychotic experiences in the general population (Polanczyk et al., 2010; Zavos et al., 2014). Adoption studies have also supported an important role for genetic factors; adopted children whose biological mother had received a diagnosis of psychosis show greater risk for the emergence of psychosis than adoptee controls (Kendler, Gruenberg, & Kinney, 1994; Tienari et al., 2003). The genes involved in the development of psychotic phenomena are thought to be polygenic with over 100 genes implicated so far, albeit the majority of research has been conducted among individuals diagnosed with schizophrenia rather than sub-clinical psychotic phenomena (Lee et al., 2012; Schwab & Wildenauer, 2013). Molecular genetic studies have only been able to explain around 30% of the variance in genetic liability for psychotic disorders – and to add further complication, the genes implicated in psychotic disorder do not appear to entirely correspond or overlap with those implicated in sub-clinical psychotic phenomena (Ripke et al., 2013; Zammit et al., 2013b). Collectively, the evidence from twin, adoption, family and molecular studies suggest that genetic factors are influential, but they do not account for all the variance in psychotic disorders and tentatively their role appears to be less apparent for

psychotic phenomena. Relatedly, these findings allude to a crucial role of the environment in the aetiology of psychosis and psychotic phenomena over and above genetic factors.

Around the turn of the 21<sup>st</sup> century there was a shift in focus from a 'bio-bio-bio model' towards investigating psycho-social influences on the development of psychosis (Read et al., 2004). Specifically, this has led to research focused upon how certain environments can increase the risk for psychosis and psychotic phenomena – and there is now extensive literature in relation to traumatic events, victimisation, cannabis, urbanicity and pre/perinatal factors (Cougnard et al., 2007; Linscott & van Os, 2013; Read, van Os, Morrison, & Ross, 2005; van Os, Kenis, & Rutten, 2010). Research has also taken advantage of longitudinal approaches in order to consider the importance of cumulative stress; for example, childhood abuse and life events have been suggested to combine synergistically to increase the odds of psychotic experiences (Morgan et al., 2014; Shevlin, Houston, Dorahy, & Adamson, 2008). Therefore, a range of environmental as well as genetic factors have been implicated in the aetiology of psychotic phenomena.

It is also important to consider why sub-clinical psychotic phenomena matter within the broader mental health field; this is particularly relevant, given that there are finite resources and funding for mental health interventions. Firstly, in terms of the short-term adverse consequences associated with sub-clinical psychotic phenomena, early experiences of psychotic symptoms are extremely distressing for young people (Kelleher et al., 2015) and have been found to increase the risk for engaging in suicidal behaviours during adolescence (Kelleher et al., 2012b). The findings reported by Kelleher and colleagues are particularly striking, whereby adolescents with suicide ideation who also reported psychotic symptoms were at 20-fold increased odds of having made suicide plans or acts, compared to those who did not report psychotic symptoms. Another crucial discovery relates to the fact comorbidity is particularly high for psychotic phenomena; it has been reported that 57% of early adolescents and 80% of mid-adolescents who report psychotic symptoms have at least one diagnosable non-psychotic disorder (Kelleher et al., 2012c). Collectively, these findings suggest that psychotic symptoms become more clinically-relevant during development given they are common amongst adolescents troubled with multiple mental health diagnoses. Indeed, 55% of adolescents who reported 3 or more diagnosable disorders also reported psychotic symptoms (Kelleher et al., 2012c). These findings suggest that psychotic phenomena that occur in early life require attention and resources channelled at interventions that can prevent them occurring or persisting could have important implications for individuals' broader mental health and wellbeing.

In the longer term, experiencing psychotic symptoms during childhood have been associated with severe, adverse mental health issues in adulthood (Fisher et al., 2013a). A prominent study conducted in the Dunedin cohort found that self-reported psychotic symptoms at age 11 predicted 16-fold increased odds for schizophreniform diagnosis at age 26 (Poulton, Caspi, Moffitt, & Cannon, 2000). Psychotic phenomena have also been found to predict other mental health problems in adulthood including suicide and post-traumatic stress disorder (Fisher et al., 2013a). It seems remarkable that psychotic symptoms in childhood predict mental health outcomes some 10 or 20 years later; relatedly, in terms of targets for interventions, these early symptoms appear to provide early indicators which are concerning in both the short and the longer term. These findings suggest it is important to identify factors that would ideally prevent the occurrence of childhood psychotic symptoms – or more realistically, prevent the ongoing presentation of these distressing experiences beyond early life into adulthood. Therefore, better understanding of the factors that protect against the development of early psychotic phenomena could be important in order to develop effective preventive interventions.

#### 1.2.2 Poly-victimisation

Victimisation is a broad term and captures a range of different types of adverse exposures including physical, sexual and emotional abuse, physical and emotional neglect, witnessing domestic violence, and bullying by peers. Victimisation has been defined by David Finkelhor as “harms caused by human agents acting in violation of social norms” (White, Koss, & Kazdin, 2011, p10). The human agency component of the definition is intentional in order to rule out harm caused by illness or natural disasters. The term victimisation is used in this thesis in order to capture a broader range of exposures where one individual intentionally harms another (abuse, neglect, bullying, violence within the family home, and criminal offences such as muggings and assaults) instead of ‘child abuse and neglect’ or ‘childhood maltreatment’. There is extensive research demonstrating the damaging effects of different types of victimisation on mental health during childhood and adolescence, alongside research evidencing how these adverse mental health trajectories can extend across the life course (Ajnakina et al., 2016; Arseneault, Bowes, & Shakoor, 2010; Fisher et al., 2010; Gayer-Anderson et al., 2015; Gilbert et al., 2009; Kessler et al., 2010; Meng, Fleury, Tao, Muzi, & Carl, 2018; Read et al., 2005; Trotta et al., 2013; Varese et al., 2012). The majority of research has focused upon childhood victimisation, although adolescence is also a critical period to

consider given this phase corresponds with the peak age for both victimisation exposure and mental health issues (Fisher et al., 2015; Schaefer et al., 2018).

There is value in understanding the impact of individual types of victimisation for studying the unique effects of each type on mental health outcomes. That said, these studies typically will not build an overall “victimisation profile” for individuals (Finkelhor, Ormrod, & Turner, 2007) and a key disadvantage of this approach is that it doesn’t account for the fact that individuals may have experienced a range of different types of victimisation beyond the type of interest (Schaefer et al., 2018). Therefore, adverse effects that are attributed to any individual type of victimisation could be over or underestimated when other types of victimisation are not accounted for, which is problematic given that individuals exposed to one type of victimisation are at higher risk for exposure to other types of victimisation (Dong et al., 2004; Radford, Corral, Bradley, & Fisher, 2013; Saunders, 2003). Furthermore, when considering the effects of victimisation beyond childhood, adolescents are known to spend an increasing proportion of their time outside of the home environment and therefore are more likely to be exposed to a wider range of victimisation types (Fisher et al., 2015).

Therefore, research has evolved beyond considering the effects of individual victimisation types and now also considers the cumulative effects of two or more different types of victimisation, known as “poly-victimisation” (Appleyard, Egeland, van Dulmen, & Sroufe, 2005; Finkelhor, Ormrod, & Turner, 2007). Various studies have identified a dose-response relationship whereby multiple forms of victimisation during childhood are associated with the most severe mental health problems across the life-span including suicide, depression and anxiety (Dube et al., 2001; Edwards, Holdenm Felitti, & Anda, 2003). Poly-victimisation has been found to have particular relevance for psychotic phenomena; studies conducted on non-clinical general population samples have found a greater risk of psychotic symptoms emerging following the occurrence of multiple adverse experiences compared to single victimisation exposures (Arseneault et al., 2011; Janssen et al., 2004; Shevlin et al., 2008; Whitfield, Dube, Felitti, & Anda, 2005). Consequently, the decision was made to consider exclusively the effects of poly-victimisation among the studies contained within this thesis because it indexes a greater risk for psychotic phenomena than single occurrences of victimisation exposure (this is discussed further below).

### 1.2.3 Protective factors



Towards the end of the 20<sup>th</sup> century, a group of pioneering researchers established a new phenomenon coined 'resilience' to represent children who showed adaptive functioning despite being at risk for psychopathology due to genetic or environmental circumstances (Luthar, Cicchetti, & Becker, 2000; Masten & Coatsworth, 1998; Masten et al., 1999; Rutter, 1985). This was a positive step for the field, since it overturned many negative assumptions and deficit or risk-focused models regarding the development of children exposed to adversity. Originally, resilience was assumed to be a rare quality of a special sub-group, however over recent decades research has evolved – with studies not only focusing on qualities of the children themselves, but also on aspects of their families and characteristics of their wider social environments (Luthar et al., 2000). In contrast to the majority of research which continues to focus on the risks associated with psychopathology, rather than on individuals who show better outcomes in the context of risk exposure, the current thesis adopts this positive approach by focusing on whether any specific protective factors are found to buffer the adverse effects of poly-victimisation in relation to psychotic phenomena.

Protective factors for the purpose of this thesis are defined as any individual, family or community-level factors that are associated with a reduced likelihood of psychotic symptoms or experiences in the context of exposure to risk (specifically poly-victimisation). Protective factors are distinct from resilience, which is a broader concept whereby individuals show adaptive functioning despite being exposed to significant risk(s) or adverse experiences (Collishaw et al., 2007; Luthar et al., 2000; Rutter, 2006). Furthermore, resilience is considered to be a dynamic process whereas protective factors are individual, family and community-level factors that support this process through which good adaptation occurs (Luthar et al, 2000). Nevertheless, protective factors and resilience are complimentary areas of research; the well-established field of resilience can provide direction in relation to key areas to explore in order to identify specific factors associated with adaptive mental health outcomes, whilst research into more granular protective factors can provide insights into the mechanisms that underlie the process of resilience. Typically, protective factors fall into three broad categories: individual, family, and community-level factors (Jaffee, Caspi, Moffitt, Polo-Tomás, & Taylor, 2007; Meng, Fleury, Tao, Muzi, & Carl, 2018), and refer to the presence of something positive which buffers the effects of adversity, as opposed to the absence of a risk factor (Brumley & Jaffee, 2016).

Protective factors are also closely related to promotive factors which tend to refer to factors associated with an absence of problematic outcomes (Brumley & Jaffee, 2016) and are associated with enhanced psychological wellbeing (Patel & Goodman, 2007). A statistical

distinction is often made between promotive factors and protective factors, with the latter being defined through the presence of an interaction between the given “protective” factor and the risk context, for example victimisation exposure – although there is notable inconsistency in definitions within the literature (Brumley & Jaffee, 2016; Meng et al., 2018). Therefore, in this thesis, factors are referred to as protective where an association was found between a given factor, for example social support, and the absence of psychotic phenomena in the context of poly-victimisation. This approach is consistent with other studies (Howell & Miller-Graff, 2014; Pérez-González, Guilera, Pereda, & Jarne, 2017). The term “promotive” was deemed less appropriate given the key focus herein relates to factors associated with an absence of psychotic phenomena in the context of poly-victimisation and the term promotive by definition does not necessarily assume any exposure to risk. Furthermore, “promotive” implies enhanced psychological wellbeing, whereas this thesis considers an absence of psychotic phenomena as opposed to relatively positive or above average outcomes.

### **1.3 Poly-victimisation & psychotic phenomena**

The likelihood of psychotic phenomena developing is known to be higher amongst young people exposed to different types of victimisation during childhood and adolescence (Ajnakina et al., 2016; Arseneault et al., 2011; Fisher et al., 2013b; Trotta et al., 2013; Trotta, Murray, & Fisher, 2015). These associations have been well documented and supported across a range of study designs (Kessler et al., 2010; Varese et al., 2012). That said, exposure to more than one type of adversity in childhood (poly-victimisation) has been suggested to be associated with an even greater risk of developing psychotic symptoms (Arseneault et al., 2011; Janssen et al., 2004; Kelleher et al., 2013; Shevlin et al., 2008). The robustness of the association is well-established, the aetiological role of how victimisation directly or indirectly leads to psychosis has been a well-debated issue in the literature (Morgan & Fisher, 2007; Read, van Os, Morrison, & Ross, 2005; Schaefer et al., 2018; van Winkel, van Nierop, Myin-Germeys, & van Os, 2013). Whilst the nature of the association continues to be debated, various studies have looked to establish psychological and biological mechanisms that underlie the complex association between victimisation and psychotic phenomena. These are briefly outlined below.

Psychological or cognitive models are naturally applicable given cognitive biases are evident amongst individuals with psychotic symptoms; these include jumping to conclusions,

difficulties with theory of mind and a tendency to attribute negative events to external factors (Bentall et al., 2009). Some psychological models have suggested that adverse experiences, particularly when they repeatedly occur as per poly-victimisation, increase the likelihood of negative self-esteem and promotes a negative attributional style (Bentall & Fernyhough, 2008; van Winkel, van Nierop, Myin-Germeys, & van Os, 2013). Overtime, this creates a tendency for individuals to anticipate social situations in a threatening way and can result in the development of negative beliefs about the self as vulnerable to threat and reduce self-esteem (Garety, Bebbington, Fowler, Freeman, & Kuipers, 2007). Overtime, if negative events persist, this can promote a negative cognitive style – characterised by jumping to conclusions and reality distortion – and in turn these manifest as psychotic symptoms (Bentall & Fernyhough, 2008; Freeman et al., 1998; Garety et al., 2007). These models are consistent with the findings that low self-esteem and an external locus of control have previously been associated with an elevated risk of psychotic symptoms (Thewissen et al., 2011; Thompson et al., 2011).

Psychological mechanisms have also been implicated through reports that the content of hallucinations and delusions amongst individuals exposed to victimisation are often reminiscent of the adverse experiences (Fisher et al., 2013b; Hardy et al., 2005; Read, Agar, Argyle, & Aderhold, 2003; Read et al., 2005). Additionally, other forms of psychopathology resulting from early victimisation exposure could form a pathway towards later psychotic symptoms (Fisher et al., 2013b), given that adverse childhood experiences have been shown to predict later depression and anxiety (Johnson et al., 2002; Reijntjes, Kamphuis, Prinzie, & Telch, 2010). These symptoms have also been found to precede psychosis (Freeman & Fowler, 2009; Krabbendam et al., 2005). Other psychological theories have suggested dissociation, and to a lesser extent attachment theory, may also play an important role in explaining the association between victimisation and psychotic phenomena (Read, van Os, Morrison, & Ross, 2005).

Researchers have attempted to integrate psychological and biological paradigms in order to explain the aetiological role of victimisation on psychotic phenomena to varying degrees of success. Key biological candidates have included genetics, dopamine, and stress sensitivity in terms of critical mechanisms or pathways linking victimisation and psychosis. As alluded to earlier, the role of genetics is crucial to consider in relation to psychotic phenomena emerging, which remains unchanged in the context of victimisation exposure; primary explanations for how genes and the environment interplay tend to be two-fold (although these are not mutually exclusive and can operate in parallel). First, genetic liability

may explain why individuals are more likely to be exposed to victimisation, a phenomenon known as gene-environment correlation, which suggests that individuals with a genetic predisposition for psychosis may therefore be more likely to be exposed to victimisation. For instance, this genetic liability may manifest in atypical behaviour which means the child is singled out by bullies; the child may be more inclined to seek out certain environments in which victimisation happens to be more common, or their parents (who have provided them with the genetic vulnerability) have a severe mental health problem and are thus at greater risk of neglecting or abusing them (Rutter, Caspi, & Moffitt, 2006; van Winkel et al., 2013). Secondly, genetic factors could influence individuals' reactions to victimisation exposure, a concept known as gene-environment interaction. Studies have shown that the association between victimisation during early life and psychotic phenomena is stronger amongst those with a family history of psychosis (Husted, Ahmed, Chow, Brzustowicz, & Bassett, 2010). For example, one adoption study found that individuals whose biological mother had schizophrenia spectrum disorder were more likely to develop psychosis when subjected to adverse adopted family environments, compared to those whose biological mothers did not have any psychotic disorder whom were also exposed (Tienari et al., 2004). The search for genes to explain these associations is ongoing, with some evidence found for specific genetic factors moderating the effect of childhood trauma on sub-clinical psychotic phenomena (Aas et al., 2012; Alemany et al., 2011; Collip et al., 2013). That said, multiple trauma exposures during childhood have been found to predict psychotic symptoms in the general population after accounting for genetic liability, suggesting genetic factors cannot fully account for this association (Arseneault et al., 2011).

Evolutionary-biological reasoning suggests individuals will have different levels of susceptibility to the negative effects of adversity (Belsky & Pluess, 2009). Heightened reactivity to stress is a central feature of psychosis and relatedly, diathesis-stress models have been dominant amongst aetiological theories of schizophrenia for decades. Diathesis stress models propose psychotic phenomena result from an interaction between environmental stress and genetic vulnerability (Rothenhal, 1970; Monroe & Simons, 1991). Psychosis models continue to evolve but stress mechanisms remain central to many biological theories – whereby psychosocial stressors have lasting effects on the HPA axis which in turn play a key role in the development of psychotic phenomena (Read et al., 2005). These models are supported by a wide body of literature, demonstrating over-reactivity and dysregulation of the HPA axis amongst abused children (Cicchetti, Rogosch, & Cox Kearns, 2001; De Bellis et al., 1994; Heim, Ehler, & Hellhammer, 2000; Read et al., 2005).

Furthermore, increased stress sensitivity is a distinctive feature amongst clinically psychotic patients who were exposed to childhood trauma (Gibson et al., 2014; Lardinois, Lataster, Mengelers, van Os, & Myin-Germeys, 2011) and has also been associated with psychotic experiences cross-culturally in the general population (DeVylder et al., 2016). It has also been suggested that stress reactivity may not purely be an expression of genetic liability, but in fact an acquired vulnerability linked to prior stressful experiences (Lardinois et al., 2011).

Dopamine has been commonly implicated in the aetiology of psychosis (Howes & Murray, 2014). The dopamine hypothesis was founded by pharmacological findings; the fact that antipsychotics reduce psychotic phenomena by blocking dopamine receptors and also drugs that activate the dopamine system induce psychotic symptoms (Abi-Dargham, 2004; Curran et al., 2004; Howes et al., 2009). Relatedly, it has been proposed that ongoing exposure to trauma may increase risk for psychosis through its effects on dopamine function (Read et al., 2005; Spauwen, Krabbendam, Lieb, Wittchen, & van Os, 2006). Support for this has come from animal studies, whereby exposure to threatening or negative events in rats and mice led to dopaminergic hyperactivity and over time ongoing exposure of adverse events leads to increased sensitivity of the dopamine system (Berton et al., 2006; Tidey & Miczek, 1996). Another study found psychosocial stress induced significant mid-brain dopamine release amongst individuals reporting low parental care; interestingly, this dopaminergic brain response also correlated with a stress cortisol response (Pruessner, Champagne, Meaney, & Dagher, 2004).

#### **1.4 Protective factors & psychotic phenomena**

A wide range of putative protective factors are investigated in this thesis; these fall into three broad levels including individual, family and community-level factors – which is consistent with the broader literature considering protective factors (Pérez-González et al., 2017). The literature focused upon protective factors for psychotic phenomena is extremely limited, as detailed in the literature review (Chapter 2); therefore in this section the risk literature is partly drawn upon to hypothesise regarding factors whose inverse may serve to be protective, as well as wider research which has focused upon factors found to be protective for other mental health problems. A given trait or multi-level factor can be both a risk and protective factor, which is dependent on the extent of linearity of the relationship between the putative protective factor (independent variable) and outcome measure (Brumley & Jaffee, 2016; Herrenkohl, Lee, & Hawkins, 2012). For example, higher levels of social support

could be protective against psychotic phenomena compared to average levels, whilst lower levels of social support could be a risk factor relative to average levels; alternatively, only one of these may be true. Evidently risk and protective factors are not mutually exclusive. A focus on protective factors allows researchers to approach the field of psychotic phenomena with a counter approach by setting out to select positive variables, whether implicated within the risk literature or not. The benefit of this approach is that as long as a theoretical basis exists for a given factor being associated to a reduced likelihood of psychotic phenomena, the prior literature need not influence or constrain research questions and hypotheses.

This thesis will start by considering individual-level factors that may be protective. It has been well documented in the general population that children who report psychotic symptoms have a lower IQ (Johns et al., 2004; Polanczyk et al., 2010) and IQ declines in childhood have also been associated with psychotic symptoms in adulthood (Kremen et al., 1998). It has been suggested that lower IQ may be a non-specific risk factor for psychosis-related phenotypes or that lower IQ may be an expression of a general neurodevelopmental impairment on the pathway to psychosis (Horwood et al., 2008). It is therefore possible that elevated IQ levels may protect against the development of psychotic symptoms. A study from the ALSPAC cohort showed that both low and high IQ scores were associated with an increased risk of psychotic symptoms amongst children at age 12, indicating that different IQ levels might show different associations with psychotic phenomena, with above average scores being associated with the lowest likelihood (Horwood et al., 2008). Therefore, it would be interesting to further explore the relationship between IQ and psychotic phenomena amongst children and adolescents exposed to multiple forms of victimisation. There are a wide range of other cognitive and psychological factors, some of which are highly correlated with IQ, that might also be protective in relation to psychotic symptoms. Poor executive functioning and impaired theory of mind have been shown to be associated with an increased risk of psychotic symptoms in children at age 12 (Polanczyk et al. 2010) and thus the reverse of these might be protective.

Personality dimensions such as cooperativeness have been found to distinguish between individuals who do not have any psychotic experiences and those who have some symptoms or clinical disorder (Fresán et al., 2015). Consciousness and extraversion have also been associated with broader resilience (Campbell-Sills, Cohan, & Stein, 2006). It is possible that individuals who have certain personality traits are more likely to be able to develop close friendships and elicit support from others when needed. It would be interesting to investigate whether temperament or personality is protective in relation to the association

between psychotic phenomena in the context of adversity exposure. Studies have also highlighted a buffering effect of physical activity in relation to depression and anxiety disorders, as well as improving self-esteem (Callaghan, 2004; Goodwin, 2003; Harvey, Hotopf, Overland, & Mykletun, 2010), and evidence has also been found for exercise improving general functioning amongst schizophrenia patients (Firth, Cotter, Elliott, French, & Young, 2015). Furthermore, certain coping styles such as problem solving, positive thinking and help seeking (Bonanno, 2004; Dumont & Provost, 1999; Jalbrzikowski et al., 2014; Kommescher et al., 2016), and cognitive flexibility (Kashdan & Rottenberg, 2010) are considered to bolster resilience against mental health problems including amongst those with psychosis – and thus may also protect against the onset of psychotic symptoms amongst poly-victimised youth.

Protective factors within the family environment have received limited attention, especially within the context of psychotic symptoms amongst victimised individuals. However, it is possible to also draw upon the wider literature in order to explore their potential protective role. A number of studies using the rich dataset from the Environmental Risk Longitudinal Twin Study, as per studies in this thesis, have considered the role of family-level protective factors in response to victimisation; whilst none of these studies focused on psychotic phenomena specifically, the outcomes of these studies are associated with positive adjustment across various other domains. Protective family characteristics identified have included maternal and sibling warmth, as well as a positive atmosphere in the home, which were found to protect against the development of internalising and externalising problems among bullied children (Bowes, Maughan, Caspi, Moffitt, & Arseneault, 2010). It would therefore be interesting to explore whether any of these positive family characteristics are protective beyond bullying victimisation and are also associated with a reduced likelihood of developing psychotic symptoms amongst children who have been exposed to poly-victimisation.

Wider social support networks and quality social relationships can naturally exist outside the family, which seems particularly relevant when looking at psychotic phenomena during adolescence onwards, where individuals will spend more time outside the home during this developmental period. A review investigating studies which considered the effects of social support on psychosis found that levels were diminished amongst individuals with first-episode psychosis as well as amongst non-clinical samples who reported psychotic experiences or had schizotypal traits (Gayer-Anderson & Morgan, 2013). Given that low social support has been found to constitute a risk factor for psychosis it seems plausible that

elevated levels of social support could also be protective. Indeed, it has been found that adults who reported experiencing physical abuse in childhood were less likely to develop psychotic disorders when they had high levels of social support (Gayer-Anderson et al., 2015). It remains to be seen whether a similar protective effect might be operating in relation to psychotic phenomena amongst poly-victimised individuals in the general population.

It may also be valuable to consider that the broader environment at a neighbourhood-level might also have protective influences. For example, lower crime neighbourhoods may have protective qualities; since it was found that individual strengths distinguished resilient from non-resilient maltreated children at age 7 under conditions of low, but not high, family and neighbourhood stress (Jaffee et al., 2007). It has also been shown that urbanicity is a risk factor for childhood psychotic symptoms emerging, with low social cohesion and crime victimisation explaining about a quarter of this association (Newbury et al., 2016). Therefore, the protective nature of the neighbourhood (e.g., greater levels of social cohesion, lower crime rates) could also prove to be an interesting area for further research.

### **1.5 Thesis outline**

This thesis investigates protective factors for psychotic phenomena in the context of poly-victimisation during childhood and adolescence. Firstly, the Literature Review (Chapter 2) summarises the existing body of research in relation to protective factors and psychotic phenomena amongst individuals exposed to multiple forms of victimisation. Next, the main methods utilised in this thesis are presented. This is followed by four empirical studies which utilise data from the Environmental Risk (E-Risk) Longitudinal Twin Study, a cohort of 2,232 twins born in England and Wales in the early 1990s. Two of the empirical chapters (Chapters 4 & 5) contain three published articles and thus these have been presented in published format or as the version that has been accepted for publication. The remaining chapter (Chapter 6) is provided in traditional thesis format. The reference list at the end of this thesis combines references for all traditional thesis chapters including; Introduction (Chapter 1), Literature Review (Chapter 2), Methods (Chapter 3), Chapter 6 and Discussion (Chapter 7). The thesis finishes with a discussion of the overall findings in relation to the aims and hypotheses and concludes with directions for future research. This Introduction represents the first chapter and an outline of the subsequent chapters is provided below.



**Chapter 2:** A chapter providing a review of the literature which has been undertaken in a systematic fashion to ensure a detailed, thorough search was conducted. Specifically, this review considers individual, family and wider-community protective factors in the broadest sense for clinical and sub-clinical psychotic phenomena in the general population.

**Chapter 3:** This chapter provides a detailed overview of the methods and statistical analyses for all four empirical studies within this thesis. There are individual methods sections within each of the empirical chapters although additional detail is provided within this Methods chapter including a more comprehensive description of the E-Risk study design and also more detail on the key measures contained within the results chapters.

**Chapter 4:** This results chapter presents an empirical study which considered the role of multi-level protective factors for childhood psychotic phenomena amongst children exposed to poly-victimisation (Crush, Arseneault, Jaffee, Danese, & Fisher, 2018a). This study considers a wide range of putative protective factors including: individual factors (IQ, executive functioning, pro-social behaviour and temperament), family factors (maternal warmth, sibling warmth, atmosphere at home), and community-levels factors (social cohesion), plus a cross-level factor (supportive adult figure).

**Chapter 5:** The second empirical chapter which considers similar research questions to the above study, albeit during the later developmental phase of adolescence. This study considers whether individual (IQ, coping strategies, physical activity) family (atmosphere at home), community (social cohesion) and cross-level (social support) factors are found to be protective for psychotic experiences amongst adolescents exposed to multiple forms of victimisation (Crush et al., 2018b). The second part of this chapter represents a brief follow-up study which considers whether there are gender differences in the protective effects of social support in relation to psychotic experiences amongst adolescents exposed to poly-victimisation (Crush, Arseneault, & Fisher, 2018c).

**Chapter 6:** The third results chapter is an empirical study which employs discordant twin design methods to explore the relative family-wide and unique environmental influences on the protective effects of social support in relation to adolescent psychotic phenomena. This is considered in the whole general population sample and amongst the high-risk poly-victimised group of adolescents.

**Chapter 7:** The final chapter provides a summary of the key findings from each of the results chapters and considers these findings in the context of the broader literature. This chapter

also outlines the limitations of the current thesis and suggests potential areas for future research. Finally, the implications of this thesis are explored.

### **1.6 Aims & Hypotheses**

The aim of the research presented in this thesis is to investigate protective factors for psychotic phenomena amongst children and adolescents exposed to multiple forms of victimisation. The specific aims are:

1. Consider whether individual, family and community-level factors are associated with a reduced likelihood of childhood psychotic symptoms amongst the general population and also whether any of these factors are found to be protective amongst children at high risk by virtue of being exposed to multiple forms of victimisation during childhood (Chapter 4).
2. Consider whether individual, family and community-level factors are associated with a reduced likelihood of adolescent psychotic experiences amongst the general population and whether these factors are also found to be protective amongst adolescents exposed to poly-victimisation (Chapter 5, Part 1).
3. Investigate whether there are gender differences in terms of the protective effects of social support in relation to adolescent psychotic experiences amongst individuals exposed to poly-victimisation (Chapter 5, Part 2).
4. Using discordant twin methods, investigate whether the protective effects of social support on adolescent psychotic phenomena is environmentally mediated or whether this association can be accounted for by family-wide factors (Chapter 6).

Based on these aims, it is hypothesised that;

1.1 Psychotic symptoms will be more prevalent amongst children exposed to poly-victimisation than those exposed to one or no types of victimisation.

1.2 Amongst the group of children exposed to poly-victimisation, various factors across all three levels will be associated with a reduced likelihood of psychotic symptoms emerging.

1.3 Various multi-level factors will be associated with a reduced likelihood of childhood psychotic symptoms emerging in the general population.

2.1 Psychotic phenomena will be more prevalent amongst adolescents exposed to multiple forms of victimisation during adolescence compared to those exposed to one or no types.

2.2 Various factors across all three levels will be associated with a reduced likelihood of adolescent psychotic experiences emerging in the general population.

2.3 The same multi-level factors (as in 2.2) will be protective against clinically-verified adolescent psychotic symptoms, in the general population.

2.4 A range of multi-level factors will be associated with a reduced likelihood of psychotic phenomena emerging among the group of adolescents exposed to poly-victimisation.

3.1 Amongst adolescents exposed to poly-victimisation, social support will show stronger protective effects in relation to psychotic experiences for girls relative to boys.

4.1 The association between social support and a reduced likelihood of adolescent psychotic phenomena will be influenced by unique environmental influences in the general population, thus the association will not be fully accounted for by family-wide factors.

4.2 Reverse causality (i.e. earlier psychopathology) will not account for the association between social support and a reduced likelihood of adolescent psychotic phenomena in the general population.

4.3 The association between social support and a reduced likelihood of adolescent psychotic phenomena will be significantly influenced by unique environmental influences among the poly-victimised group, thus the association will not be fully accounted for by family-wide factors.

4.4 Reverse causality will not account for the association between social support and a reduced likelihood of adolescent psychotic phenomena in the poly-victimised group.

### **1.7 Power Calculations**

Power calculations were completed prior to data analysis using STATA and the “SAMPSI” command. A selection of examples of these are detailed below:

Hypothesis 1.1:

There are 113 participants exposed to poly-victimisation in childhood and 80.7% of this group did not report psychotic symptoms at age 12. In the comparison group, there are 2,127 participants who were not exposed to more than one type of victimisation in childhood, of which 95.1% did not report psychotic symptoms. Power calculations were

completed for this study prior to data analysis and it was found that using an alpha of 0.05 the estimated power was 0.997.

#### Hypothesis 1.2:

In the poly-victimised group, the mean IQ of the 113 participants who did not develop psychotic symptoms is 93.0 (SD=13.3). In the comparison group, there are 27 participants who did develop psychotic symptoms, this group had a mean IQ of 86.4 (SD=12.2). Power calculations based on these figures using an alpha of 0.05 was found to be 0.698.

#### Hypothesis 1.3:

In the whole sample, the mean IQ of the 2002 participants who did not develop psychotic symptoms is 100.5 (SD=14.9). In the comparison group, there are 125 participants who did develop psychotic symptoms, this group had a mean IQ of 93.0 (SD=14.6). Power calculations based on these figures using an alpha of 0.05 was found to be 1.0.

#### Hypothesis 2.1:

There are 334 participants who were poly-victimised during adolescence and 134 (40.1%) of this group did not report psychotic experiences at age 18. In the comparison group, there are 1,728 participants who were not poly-victimised, of which 75.6% did not report psychotic experiences. Power calculations were completed for this study prior to data analysis and it was found that using an alpha of 0.05 the estimated power was 1.0.

#### Hypothesis 2.2:

In the whole sample, the mean social support score of the 1440 participants who did not develop psychotic experiences is 21.3 (SD=3.9). In the comparison group, there are 623 participants who did develop psychotic experiences, this group had a mean social support score of 19.3 (SD=5.0). Power calculations based on these figures using an alpha of 0.05 was found to be 1.0.

#### Hypothesis 2.4:

In the poly-victimised group, the mean social support score of the 134 participants who did not develop psychotic experiences is 20.1 (SD=5.0). In the comparison group, there are 200 participants who did develop psychotic experiences, this group had a mean social support score of 18.1 (SD=5.4). Power calculations based on these figures using an alpha of 0.05 was found to be 0.934.

## **Chapter 2: Literature Review**

### **2.1 Introduction**

Literature focused upon victimisation during childhood or adolescence and the later emergence of psychotic phenomena has been extensive over the past decade as outlined in Chapter 1 (Varese et al., 2012; Mackie, Castellanos-Ryan & Conrod, 2011). Victimisation and poly-victimisation are now well established as major risk factors for the emergence of psychotic phenomena during childhood and adolescence (Janssen et al., 2004; Kelleher et al., 2013; Trotta, Murray, & Fisher, 2015). However, a reasonable proportion of individuals exposed to victimisation do not go on to develop psychotic phenomena or clinical psychosis and research has not addressed the reasons for this in any significant way. Ultimately it could be useful to better understand what protects those individuals who do not develop psychotic phenomena despite exposure to a major risk factor such as poly-victimisation in order to inform preventive interventions for other at-risk individuals.

Research focused upon individual, family or community-level factors which protect or buffer against the onset of psychotic phenomena is not well-established, particularly in the context of victimisation exposure. The aim of this literature review is to understand to what extent empirical literature has been undertaken in this area. This review has been conducted in a systematic way to ensure that all possible studies are identified which could inform the research questions under investigation in the current thesis. Specifically, this review will consider which multi-level factors have been considered as candidates for protective factors for psychotic phenomena among victimised individuals and critically discuss the methods used by these studies. Given the anticipated scarcity of literature, this review will consider psychosis in the broadest terms ranging from psychotic experiences in the general population through to clinically diagnosable psychotic disorders.

### **2.2 Method**

#### **2.2.1 Literature search strategy**

Advanced searches of the databases Medline (PubMed), Embase, and PsycINFO were used to identify relevant studies published between 1930 and 1st June 2018. Using Boolean operator terms, the outcome-related keywords (“psychotic symptoms” OR “psychotic experiences” OR “psychotic-like” OR paranoi\* OR hallucina\* OR suspicious OR “voice

hearing" OR delusion\* OR "thought disorder" OR "psychosis proneness" OR schizo\* OR hallucinat\* OR "psychosis" OR "ultra-high risk" OR "at risk mental state" OR "prodrom\*") were combined using AND with the following protective factor keywords (protect\* OR resilien\* OR \*promot\* OR \*benefi\*) and finally combined using AND with the following exposures (victimi\* OR maltreat\* OR "abuse" OR "neglect" OR "violence" OR bull\* OR "trauma" OR "childhood adversity" OR "adverse childhood experiences").

### 2.2.2 Inclusion criteria

For papers to be included they had to meet the following criteria:

- (i) Consider protective factors or resiliency in relation to psychotic phenomena (outcome measure) amongst individuals exposed to at least one type of victimisation during childhood or adolescence (i.e., exposure occurred prior to 18 years of age)
- (ii) General population, clinical, help-seeking, or extreme samples

### 2.2.3 Exclusion criteria

Papers were excluded for the following reasons:

- (i) No between-group comparison made between those who did versus did not report psychotic phenomena
- (ii) Reviews, meta-analyses, conference abstracts, dissertations, book chapters
- (iii) Case studies or only qualitative data
- (iv) Not available in English
- (v) No information provided on how the predictor or outcome variables were measured
- (vi) Psychotic phenomena did not constitute the outcome measure
- (vii) Victimisation not incorporated into the design either by creation of a victimised subgroup or controlling for victimisation but instead this was considered as a predictor variable (only)
- (viii) No data on the bivariate association between the protective factors and psychotic phenomena variables (e.g., protective factors only considered as a confounder or covariate)

## 2.3 Results

### 2.3.1 Study selection

The database search which was undertaken in early June 2018 yielded 2,267 articles (Figure 2.1). After removal of duplicates and title screening there were only 24 potentially relevant studies, and further to abstract and methods screening, only 3 studies were found to meet the criteria outlined above for full text screening. The key features of these studies are provided in Table 2.1 and each is described in detail below. Further information on the excluded studies is provided in Section 2.3.6 and Table 2.2.

### 2.3.2 Study design

The first of the three studies included in this review is a study featured in the current thesis (Chapter 4) and has been included for completeness (Crush et al., 2018a). This study, as detailed in Chapter 4, utilised data from a nationally representative cohort, the Environmental Risk Longitudinal Twin Study which constitutes 2,232 twin children from England and Wales born in the early 1990s. The second study (Gayer-Anderson et al., 2015) used data from the Aetiology and Ethnicity in Schizophrenia and Other Psychoses (AESOP) study, which is a multi-centre population-based incidence and case-control study of first-episode psychosis. The third study utilised a convenience sample (Mongan, Shannon, Boyd, & Mulholland, 2017) where participants from the general population were recruited using Amazon's Mechanical Turk (MTurk) "crowd sourcing" service.

### 2.3.3 Assessment of psychotic phenomena

The first study (Crush et al., 2018a) considered psychotic symptoms ( $n=125$ ; 5.9%) during childhood (before age 12); assessment was in relation to seven hallucination and delusion items and based on the methodology used for assessing childhood psychotic phenomena in the ALSPAC (UK) (Schreier et al., 2009) and Dunedin (New Zealand) Study (Poulton et al., 2000) cohorts. This group of children who reported psychotic symptoms were compared to the rest of the sample who did not report psychotic symptoms during childhood ( $n=2002$ ). The second study (Gayer-Anderson et al., 2015) considered a clinical sample whereby cases had presented with a first episode of affective or non-affective psychotic disorder (International Classification of Diseases, ICD-10 codes F20-F29 and F30-F33; World Health Organisation, 1992) and had reported no previous contact with secondary mental health services for psychosis. Cases in this study ( $n=202$ ) were aged between 16 and 64 years

and lived within specific areas in south-east London and Nottingham, within the United Kingdom. Controls in this study (n=266) were randomly selected from the same geographic areas as the case group, screened negative for psychosis, and were also between the age of 16 and 64 years. The third study assessed the prevalence of psychotic symptoms in a convenience sample using The Prodromal Questionnaire (PQ-16; Ising et al., 2012), a 16-item questionnaire which consists of 9 items from the perceptual abnormalities/hallucinations sub-scale, 5 items pertaining to unusual thought content/delusional ideas/paranoia, and 2 negative symptoms. A cut-off score of 6 was used to determine those who screened “positive” indicating the presence of prodromal psychosis. Participants were all adults aged between 18-35 years.

#### 2.3.4 Measurement of victimisation exposure

The first paper (Crush et al., 2018a) considered exposure to several types of victimisation which were assessed repeatedly when the children were 5, 7, 10, and 12 years of age with dossiers compiled for each child regarding cumulative information about exposure to domestic violence between the mother and her partner; frequent bullying by peers; physical maltreatment by an adult; sexual abuse; emotional abuse; and neglect. This study considered poly-victimisation, therefore children needed to have been exposed to two or more types of victimisation at a severe level to be included in the poly-victimised group. Further information on this measure is provided in the Methods Chapter (3).

The second study (Gayer-Anderson et al., 2015) used the Childhood Experience of Care and Abuse Questionnaire (CECA-Q) (Bifulco, Bernazzani, Moran, & Jacobs, 2005) to retrospectively elicit information on experiences of childhood adversity before the age of 17. This study only included physical abuse from the main parent figures and sexual abuse by any person at least 5 years older than the victim. Screening questions relating to physical and sexual abuse were read out to all participants and positive responses were followed up with more detailed questions. Researchers then used published guidelines to score the severity of the responses in a standardised manner (Bifulco et al., 2005). The abuse measures were dichotomised and only those reporting severe levels of abuse were included in the “abused” group.

Finally, Mongan et al. (2017) used the Adverse Childhood Experiences Questionnaire (ACE-Q) (Felitti et al., 1998) to retrospectively assess adverse experiences or traumatic events during childhood, i.e. before age 18. This measure comprises multiple yes/no



questions regarding potentially traumatic experiences in childhood yielding 10 categories of specific types of adversity.

### 2.3.5 Measurement of protective factors

The first study (Crush et al., 2018a) considered a range of potential individual, family and community-level protective factors. In terms of individual-level factors, IQ was measured at age 5 using two subtests (Vocabulary and Block Design) from The Wechsler Preschool and Primary Scale of Intelligence Revised (WPPSI) (Wechsler, 1990). Executive function was measured at age 5 as the mean score of three separate tasks: Mazes (Grodzinsky & Diamond, 1992), a WPPSI subtest; Day-Night (Gerstadt, Hong, & Diamond, 1994), a nonverbal analogue of the Stroop task; and Sentence Working Memory, based on the Baddeley model of working memory (Baddeley, 1996). A temperament measure “Approach” was also used, which was assessed at age 5 by research workers after home visits. Finally, prosocial behaviour was also considered as a potential protective factor, and was derived using 10 items from the Revised Rutter Parent Scale for School-Age Children (Goodman, 1994; Sclare, 1997).

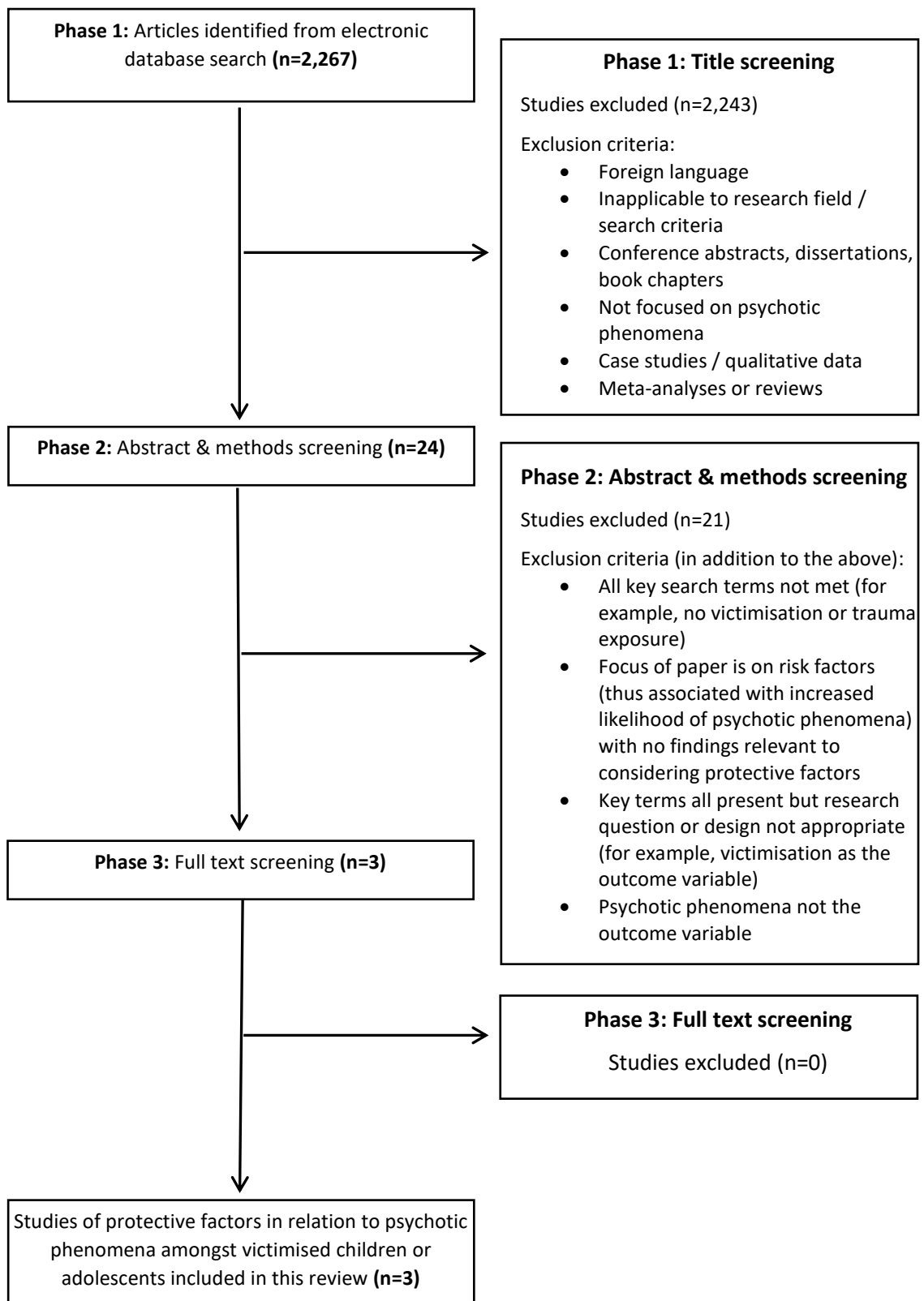
A range of family-level factors were also considered in the first study. Maternal warmth was assessed using procedures adapted from the Five-Minute Speech Sample method (Magana et al., 1986). Sibling warmth was also assessed in interviews with mothers who responded on a three-point scale to six questions. Atmosphere at home was also considered as a protective factor which was assessed by research workers following home-visits when children were ages 7 and 10. The measure derived from the Home Observation for Measurement of the Environment (Bradley & Caldwell, 1977) and the University of Washington Parenting Clinic Questionnaire (Parent–Child Observations; Webster-Stratton, 1998).

Finally, in terms of the community-level factors, social cohesion (Sampson, Raudenbush, & Earls, 1997) was assessed when children were aged 5 by asking mothers five questions, including whether neighbours trusted and got along with each other. Finally, the presence of a supportive adult was assessed at age 12 when children were asked 13 questions relating to whether they had a stable adult figure to rely upon.

The second paper by Gayer-Anderson et al. (2015) considered social support as a potential protective factor. This was assessed using the Significant Others Scale (SOS; Power, Champion, & Aris, 1988), a self-report questionnaire which measures perceived and ideal levels of practical and emotional support on a seven-point scale. The SOS also elicits the

number of significant others in participants' social networks, as well as a discrepancy score (a measure of satisfaction) between ideal and perceived levels of emotional and practical support separately.

The third paper by Mongan et al. (2017) considered a range of individual-level factors including resilience which was measured using the Brief Resilience Scale (Smith et al., 2008), coping styles measured using the Brief COPE Scale (Carver, Scheier, & Weintraub, 1989), and perceived social support using the Multi-dimensional Scale of Perceived Social Support measure (Zimet, Powell, Farley, Werkman, & Berkoff, 1990). In addition, this paper considered neighbourhood social cohesion as a potential protective factor which was assessed using an adapted version of the Neighbourhood Cohesion Scale (Fone et al., 2007) with 15-items and 2 sub-scales (social cohesion and belonging).



**Figure 2.1.** Flowchart detailing the selection process for articles included in this review

**Table 2.1:** Overview of studies which met all inclusion criteria for this literature review

Crush et al. (2018) Protective factors for psychotic symptoms among poly-victimised children (Chapter 4)							
Country	Study design	Sample size (N)	Age (years)	Protective factor(s) measure (See Methods Chapter)	Psychosis measure (See Methods)	Victimisation measure (See Methods Chapter)	Key findings relevant to literature review
England & Wales	Nationally-representative / birth cohort / longitudinal / general population sample / face-to-face assessments	2232	12	<b>IQ Age 5</b> Wechsler Preschool and Primary Scale of Intelligence Revised (WPPSI)  <b>Executive Functioning Age 5</b> WPPSI 3 sub-tests  <b>Prosocial Behaviour Age 5</b> Revised Rutter Parent Scale for School-Age Children  <b>Maternal Warmth Age 5</b> Five-Minute Speech Sample method  <b>Sibling Warmth Age 7 &amp; 10</b> Interview with mothers (6 questions on sibling relations)  <b>Atmosphere at Home Age 7 &amp; 10</b> Coder's Impression Inventory  <b>Social Cohesion Age 5</b> Interview with mothers (5 questions on neighbourhood)  <b>Supportive Adult Age 12</b> Interview with child (13 items)	Interview regarding seven hallucination and delusion items	Exposure to several types of victimisation was assessed repeatedly when the children were 5, 7, 10, and 12 years of age and dossiers were compiled with cumulative information about exposure to domestic violence, bullying, physical maltreatment by an adult, sexual abuse, emotional abuse and neglect & physical neglect  This study considered poly-victimisation therefore two or more types of victimisation at a severe level had to be present to be classified as poly-victimised	A relatively high IQ (OR=0.97; 95% CI: 0.96-0.98), more positive atmosphere at home (OR=0.93; 95% CI: 0.90-0.96) and higher levels of neighbourhood social cohesion (OR=0.89; 95% CI: 0.84-0.96) were associated with a reduced likelihood of psychotic symptoms amongst children in the general population. In the poly-victimised group a higher IQ (OR=0.96; 95% CI: 0.93-0.99) and more positive atmosphere at home (OR=0.93; 95% CI 0.87-0.99) were found to be protective.

**Abbreviations:** B=standardised beta coefficient, CI=confidence interval, OR=Odds ratio

**Gayer-Anderson et al. (2015)** Gender differences in the association between childhood physical and sexual abuse, social support and psychosis

Country	Study design	Sample size (N)	Age (years)	Protective factor(s) measure	Psychosis measure	Victimisation measure	Key findings relevant to literature review
England	Geographically-based case-control study / cross-sectional / face-to-face assessments	Cases: n=202 Controls n=266	16-64	Significant Others Scale (SOS) 3 subscales: perceived emotional support, perceived practical support and number of significant others	First episode of affective or non-affective psychosis (International Classification of Diseases (ICD-10 codes F20–F29 and F30–F33)	The Childhood Experience of Care and Abuse Questionnaire (CECA.Q) was used to elicit information on experiences of childhood adversity before age 17	<p>In the whole sample, those who reported physical abuse and had 5 or more significant others in their social network had lower odds of psychosis (OR=0.99; 95% CI 0.42–2.36), compared with those exposed to physical abuse with less than 5 (OR=3.24; 95 % CI 1.42–7.38) and this difference was significant (<math>\chi^2 = 3.90</math>, <math>p=0.048</math>)</p> <p>In the whole sample, those who reported sexual abuse and high perceived emotional support were less likely to report psychosis (OR=0.93; 95% CI 0.32-0.70) compared to those who had been sexually abused with lower perceived emotional support (OR=2.12; 95% CI 0.86-5.20) although this difference was not significant (<math>\chi^2 = 1.37</math>, <math>p = 0.242</math>).</p> <p>When stratified by gender there were no clear associations between physical or sexual abuse, current social support and odds of psychosis in men. Conversely, women who reported physical abuse and had 5 or more significant others (compared to &lt;5) were less likely to report psychosis (OR=1.37, 95% CI 0.42–4.47) than those with smaller social networks (OR=6.73, 95% CI 1.96–23.12) and this difference was statistically significant at the <math>p&lt;0.100</math> threshold used in this study for interactions (<math>\chi^2 = 3.55</math>, <math>p=0.060</math>).</p>

**Abbreviations:** B=standardised beta coefficient, CI=confidence interval, OR=Odds ratio

**Mongan et al. (2017)** The association between specific types of childhood adversity and attenuated psychotic symptoms in a community sample

Country	Study design	Sample size (N)	Age (years)	Protective factor(s) measure	Psychosis measure	Victimisation measure	Key findings relevant to literature review
United States	Cross sectional / general population / convenience sample / Online questionnaire	748	18-35	<b>Resilience scale</b> Brief Resilience Scale  <b>Coping styles</b> Brief COPE Scale  <b>Perceived social support</b> Multi-dimensional Scale of Perceived Social Support  <b>Neighbourhood cohesion</b> Neighbourhood Cohesion Scale	The Prodromal Questionnaire (PQ-16)  16 item screening tool	Adverse Childhood Experiences Questionnaire (ACE-Q)	Resilience ( $B=-0.09$ , $p=0.016$ ) and the “emotional support” coping style ( $B=-0.14$ , $p<0.001$ ) were independently associated with a reduced likelihood of psychotic symptoms after accounting for childhood adversity exposure.  Social support and neighbourhood cohesion were not found to be associated with an absence of psychotic symptoms (both $p$ 's $>0.05$ ).
<b>Abbreviations:</b> B=standardised beta coefficient, CI=confidence interval, OR=Odds ratio							

### 2.3.6 Studies excluded from this review

A total of 21 studies were excluded further to abstract and methods screening for several reasons. A summary of three of the excluded studies are provided in Table 2.2 as they were deemed to have relevance to the current thesis given they all explored “protective” factors for psychotic phenomena, albeit they did not consider this in the context of victimisation. Given the current thesis also considers factors that are associated with an absence of psychotic phenomena in the general population regardless of victimisation exposure, some information on these studies has been incorporated within the current review (Table 2.2) to provide context on the literature closest to the current area of interest.

To briefly summarise the findings from the three studies, the first study (Peters et al., 2014) found higher levels of IQ, self-esteem, and positive schema about the self and others were evident amongst those who did not report psychotic phenomena and were associated with less severe psychotic experiences relative to a clinical group. In addition, the control and non-clinical groups had higher life satisfaction and general psychological wellbeing compared to the clinical group. The second study (Tao et al., 2017) found physical activity to be associated with an absence of psychotic phenomena, specifically that low-moderate physical activity was protective against psychoticism whereas high levels were not. Finally, the third study (Marulanda & Addington, 2016) found differences in resilience scores amongst healthy individuals relative to the clinical group, specifically various subscales were identified within the broader resilience measure: personal competence, tolerance to stress, acceptance to change and sense of control.

In terms of the studies which fell outside the remit of the current review but met some of the inclusion criteria; a total of 10 studies were excluded because they focused upon risk factors or mechanisms associated with *higher* prevalence of psychotic phenomena in the context of victimisation including: emotional distress (Barahmand & Heydari Sheikh Ahmad, 2016; Leonhardt, Hamm, Belanger, & Lysaker, 2015), hippocampal volume (Samplin, Ikuta, Malhotra, Szeszko, & DeRosse, 2013), shame (Johnson et al., 2014), negative schematic beliefs (Anilmis et al., 2015; Appiah-Kusi et al., 2017), insecure or anxious attachment styles (Bucci, Emsley, & Berry, 2017; Wickham, Sitko, & Bentall, 2015), negative affect (Reininghaus et al., 2016), and stress sensitivity (Rauschenberg et al., 2017).

Four studies considered protective factors amongst clinical groups however the outcome was not related to psychotic phenomena, instead these studies considered a variety of outcomes amongst patients with psychosis including: life satisfaction (Boyette et al., 2014), life events (Pos et al., 2016), distress levels (Brett, Heriot-Maitland, McGuire, & Peters, 2014), and theory of mind (Pos et al., 2015) of patients as the dependent variable and were therefore excluded. Another study considered clinical groups and only considered relapse rates (Hultman, Wieselgren, & Ohman, 1997), which was also considered to be outside of the remit of this literature review. Finally three studies considered resilience or protective factors in relation to childhood or adolescent victimisation but they did not incorporate psychotic phenomena as an outcome and therefore they were also excluded (Howell & Miller-Graff, 2014; Kabiru, Elung'ata, Mojola, & Beguy, 2014; Singham et al., 2017).



**Table 2.2:** Overview of studies which were excluded from this review on the basis they did not include a victimised sub-group in the design

Peters et al. (2016) Clinical, socio-demographic and psychological characteristics in individuals with persistent psychotic experiences with and without a “need for care”						
Country	Study design	Sample size (N)	Age (years)	Protective factor(s) measure	Psychosis measure	Key findings relevant to literature review
United Kingdom	Case-Control Study	<b>Non-clinical:</b> (Persistent PEs): n=92	16-64	<b>IQ</b> Wechsler Adult Intelligence Scale, 3rd edition (WAIS-III)	The Appraisals of Anomalous Experiences Interview (AANEX) semi-structured interview was used to elicit participants’ current PEs and their associated emotional and cognitive correlates	The non-clinical group were similar to the controls in relation to some psychological characteristics: they did not report current emotional problems, had intact self-esteem, displayed healthy schemas about the self and others, showed high life satisfaction and wellbeing. Further details below.
		<b>Clinical group:</b> n=84		<b>Self-esteem</b> The Questionnaire for Evaluation of Self (QES) was used to assess self-esteem		
		<b>Controls:</b> n=83		<b>Core schema</b> The Brief Core Schema Scale (BCSS) was used to assess long-term held beliefs (i.e., “schemas”) about the self / others		
				<b>Psychological wellbeing</b> The Psychological Well-Being-Post-Traumatic Changes Questionnaire (PWB-PTCQ) explores any positive sequelae to traumatic experiences		
				<b>Parental bonding</b> The Parental Bonding Questionnaire (PBQ)65 was used to evaluate the participants’ retrospective perceptions of parental attitudes and behaviours towards them <16 years		
				<b>Life satisfaction</b> The Satisfaction with Life Scale (SWLS) was used to assess satisfaction with life		
				<b>Social capital</b> The Social-Environmental Assessment Tool (SEAT)		
<p>Comparing the three groups the following differences emerged; in relation to IQ, the controls had higher IQ than the non-clinical group, and the non-clinical group had higher IQ scores than the clinical group (<math>F_{2,247} = 71.1, p&lt;0.001</math>).</p> <p>The controls and non-clinical group showed higher levels of self-esteem compared to the clinical group (<math>F_{2,251} = 11.2, p&lt;0.001</math>). Although self-esteem did not differ between the control and non-clinical group.</p> <p>In relation to a positive schema of the self, the control group and non-clinical group had significantly more positive schema of the self than the clinical group (<math>F_{2,252} = 13.0, p&lt;0.001</math>), although there was no significant difference between the non-clinical and control groups. Similarly, the control group and non-clinical group has a more positive schema of others than the clinical group (<math>F_{2,250} = 5.3, p=0.006</math>), but the controls &amp; non-clinical group did not differ.</p> <p>The non-clinical group and control group reported significantly higher levels of life satisfaction (<math>F_{2,251} = 21.1, P&lt;0.001</math>) than the clinical group with no significant difference between controls and the non-clinical group.</p> <p>Finally, the control group reported the highest levels of life satisfaction (<math>F_{1,169} = 32.7, P&lt;0.001</math>), followed by the non-clinical group and the lowest levels were reported by the clinical group; significant differences were found between all groups.</p>						

**Abbreviations:** M=Mean, SD=standard deviation, B=standardised beta coefficient, OR=Odds ratio, PEs, psychotic experiences.

**Tao et al. (2017)** Physical activity might not be the protective factor for health risk behaviours and psychopathological symptoms in adolescents

Country	Study design	Sample size (N)	Age (years)	Protective factor(s) measure	Psychosis measure	Key findings relevant to literature review
China	General Population / cross-sectional / convenience sample	5141	11-18	<b>Physical activity</b> Two questions about physical activity (PA). Participants were asked how many times in a normal week they engaged in vigorous physical activities making you sweat and breathe hard (e.g. running) or moderate physical activities making you not sweat or breathe hard (e.g. walking) for at least 20 min. Responses were used to calculate a PA score based on frequency of participation in 'vigorous' and 'moderate'	Psychopathological symptoms in the past week were assessed using the Symptoms Checklist 90.  A 90 item (5-point rating scale is used in each item) and is sorted into nine primary symptom dimensions: somatisation, obsessive-compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation and psychoticism	The results showed 22.0% adolescents participated in high-intensity physical activity, 37.0% in low-moderate and 41.0% adolescents engaged in very-low-intensity physical activity.  3.3% of the low-moderate intensity and 1.1% of the high intensity physical activity group scored highly on the psychoticism score.  Low-moderate-intensity PA was found to be a protective factor for psychoticism (OR=0.54; 95% CI: 0.31–0.93; P<0.05), however high physical activity was not (OR=0.84; 95% CI: 0.49-1.46).

**Marulanda & Addington (2016)** Resilience in individuals at clinical high risk for psychosis

Country	Study design	Sample size (N)	Age (years)	Protective factor(s) measure	Psychosis measure	Key findings relevant to literature review
Canada	Case-control study / longitudinal	<b>Cases:</b> n=40  <b>Controls:</b> n=40	<b>Cases:</b> M=17.05; SD=2.69  <b>Controls:</b> M=19.13; SD=1.36	<b>Resilience</b> Connor–Davidson Resilience Scale (CD-RISC) and; The Child and Youth Resilience Measure (CYRM)	The Structured Interview of Psychosis-risk Syndromes (SIPS) and The Scale for Assessment of Prodromal Symptoms	Clinically high risk patients showed lower levels of resilience (t=4.34; P<0.01) compared to healthy controls. In terms of the resilience sub-scales including personal competence (t=4.04; P<0.01), tolerance to stress (t=2.79; P<0.01), acceptance to change (t=4.17; P<0.01) and control (t=3.14; P<0.01).

**Abbreviations:** M=Mean, SD=standard deviation, B=standardised beta coefficient, OR=Odds ratio, PEs, psychotic experiences.

## 2.4 Discussion

The aim of this literature review was to understand the existing literature in relation to protective factors for psychotic phenomena amongst individuals exposed to some form of victimisation during childhood or adolescence. Only three studies were identified to meet the inclusion criteria (Table 2.1), one of which is part of the current thesis. The studies considered a wide range of individual, family and community-level factors in terms of whether they were found to have protective or buffering effects in relation to psychotic phenomena amongst individuals exposed to at least one type of victimisation. Only the paper included in the current thesis (Crush et al., 2018a) considered exposure to multiple forms of victimisation (poly-victimisation), the other two studies considered individual victimisation exposures.

All three studies confirmed a strong association between victimisation exposure and psychotic symptoms or clinical psychosis (Crush et al., 2018a; Gayer-Anderson et al., 2015; Mongan et al., 2017). Two of the papers (Crush et al., 2018a; Mongan et al., 2017) considered sub-clinical psychotic phenomena in general population samples and the third study was focused on a clinical group with psychosis (Gayer-Anderson et al., 2015). The prevalence of psychotic phenomena in the general population samples was 5.9% for childhood psychotic symptoms (Crush et al., 2018a) and ranged between 7.9% and 57.2% for individual psychotic symptoms in the early to mid-adulthood sample (Mongan et al., 2017). The difference between the prevalence rates is possibly explained by the fact the first study required psychotic symptoms be verified by expert psychiatrists and childhood psychologists, therefore these are clinically-relevant and thus rarer phenotypes. Additionally, the second study utilised an online questionnaire which could have created survey bias given individuals may be less concerned about stigma providing responses in a more private setting. In addition, the questionnaire did not entail follow-up questions or explanation of any items which were answered positively. This could have meant that some genuine, non-psychotic experiences were captured which actually happened (e.g., a real incident of being followed by a stranger) as opposed to being imagined, therefore this questionnaire method may have led to the overestimation of psychotic phenomena. The second study also used a crowd-sourcing method to gather participants which may have led to sampling bias, potentially attracting a greater (or lower) proportion of individuals who have mental health problems, and therefore this study may not represent a normal distribution sample, particularly given the sample size was relatively small (N=748). In addition, prevalence rates are known to differ across the lifespan for psychotic phenomena (van Os et al., 2009; Kelleher et al., 2012c).

In terms of individual-level protective factors, Crush et al. (2018a) incorporated a range of factors including; IQ, executive functioning and pro-social behaviour. This study identified higher levels of IQ to be protective in the context of poly-victimisation in relation to childhood psychotic symptoms. Mongan et al. (2017) also considered individual-level factors through considering the extent to which resilience and coping styles were associated with psychotic symptoms. This study found both resilience and the “seeking emotional support” coping style were independently associated with a reduced likelihood of psychotic symptoms, after controlling for childhood adversity exposure. Crush et al. (2018a) was the only study to consider a range of family-wide factors as putative protective factors including maternal warmth, sibling warmth and atmosphere at home. This study found atmosphere at home to be protective in the context of poly-victimisation.

In terms of broader, cross-level factors which could occur inside or outside the home environment, Gayer-Anderson et al. (2015) considered the protective effects of social support and similarly Mongan et al. (2017) considered “perceived” social support, albeit using a different measure. Gayer-Anderson et al. (2015) reported detailed results regarding different types of social support including perceived emotional support, perceived practical support and also the number of significant others. The key finding with relevance to the current review was the fact the number of significant others during adulthood was associated with lower odds of psychosis among individuals exposed to childhood physical abuse. Furthermore, emotional support was associated with reduced odds of psychosis among individuals exposed to sexual abuse in childhood. When stratified by gender, the study found that these effects were only apparent among women and specifically the number of significant others (5 or more) modified the effect of childhood physical abuse on the odds of psychosis, whereby women who had been exposed to physical abuse during childhood had lower odds of psychosis if they reported a larger number (5 or more) of significant others during adulthood, compared to those with smaller social networks. An interaction between physical abuse and the number of significant others was found to be significant which supported the presence of a protective effect for this social support measure amongst women. Conversely, Mongan et al. (2017) did not find a significant effect of perceived social support on an absence of psychotic symptoms in their study.

Finally, in terms of community-level protective factors, Crush et al. (2018a) and Mongan et al. (2017) both considered neighbourhood social cohesion, albeit using different measures for this. Crush et al. (2018a) found neighbourhood social cohesion was associated with an absence of psychotic symptoms in the general population with a strong trend for this

being protective in the poly-victimised group, whereas Mongan et al. (2017) did not which could be linked to a number of factors relating to the differing methodology utilised by each study. The former paper uses a more extreme version of victimisation (poly-victimisation) which could change the association. Alternatively, this could be linked to the fact the studies focus on different age periods, Crush et al. (2018a) was focused on childhood when children are less likely to move and therefore exposed to more consistent levels of cohesion, whereas Mongan et al. (2017) focused on adulthood which could lead to more inconsistency in social cohesion levels. It is also possible that different factors are protective during different development phases. It is difficult to draw firm conclusions on any differences observed in the current review given the distinct lack of literature in this area.

In terms of the timing of when the predictor and outcome variables were measured, Crush et al. (2018a) used longitudinal analyses where possible thus considering protective factors measured earlier in childhood in the majority of instances, although the specific timing of when psychotic phenomena occurred during childhood was not available and therefore caution is needed regarding interpreting the direction of the association between protective factors and psychotic phenomena. Gayer-Anderson et al. (2015) used a cross-sectional design to investigate different types of social support in adulthood and buffering effects in relation to victimisation exposure during childhood in a clinical group. Therefore, childhood victimisation was retrospectively measured in adulthood, whilst social support and the presence of psychosis were measured at the specific time-point during adulthood. This design raises questions around interpreting the direction of the relationship between social support and psychosis onset, particularly given the time elapsed since the victimisation exposure.

Mongan et al. (2017) utilised an online questionnaire and therefore all analyses are cross-sectional in nature in relation to the exposure, protective factors, and psychotic symptoms assessed. Finally, two of the studies (Gayer-Anderson et al., 2015; Mongan et al., 2017) used retrospective reports of childhood victimisation which may also have a potential for recall bias (Hardt & Rutter, 2004), albeit research has suggested that retrospective recall of victimisation in childhood is reasonably reliable and stable over time, even amongst psychotic patients (Fisher et al., 2011; Goodman et al., 1999). Further research is needed which ideally would utilise prospective longitudinal designs to allow the directionality of associations between protective factors and psychotic phenomena to be better understood – this requires protective factors to be measured prior to the occurrence of psychotic phenomena.

#### 2.4.1 Methodological considerations

This literature review aimed to identify any papers where factors which are “protective” for psychotic phenomena and relatedly it is possible that the terminology, i.e. the term “protective” may not always be used in the literature. Whilst a range of terms were used to capture relevant words including buffering, resilience, promotive and beneficial, it is possible that studies may have considered factors associated with an absence of psychotic phenomena but not used any of the terms that were stated in the inclusion criteria. There was no practical way around this point given there are so many potential candidates that it was unfeasible to include terms related to every possible specific protective factor. However, it is important to acknowledge this could have meant that some potentially relevant studies were not identified. In addition, it was not possible to include some highly relevant conference abstracts due to the lack of detail contained within them; presumably these relate to publications which are forthcoming but at this stage it was not possible to include this research in the current review. Finally, it is possible that relevant papers may have been available in other languages and were therefore not included.

#### 2.4.2 Conclusions

This literature review only identified a very limited number of relevant studies and it can therefore be concluded that there is a distinct lack of literature in relation to protective factors for psychotic phenomena in the context of victimisation exposure during childhood and adolescence. In Chapter 1, it has already been explained why research focused on psychotic phenomena is important, and relatedly, why there is a need for research to inform the development of effective interventions to prevent the emergence of such phenomena, which are relatively common amongst those exposed to victimisation and even more so amongst those exposed to poly-victimisation. Therefore, this thesis will attempt to address this major gap by exploring a range of potential multi-level protective factors for psychotic phenomena among poly-victimised children and adolescents.

## **2.5 Distinct and original contribution to the field**

The research presented in this thesis directly contributes towards an area in the literature which has fundamental gaps, as demonstrated by this literature review. Excluding the study already presented in this thesis, there are only 2 studies which have considered the role of protective factors in relation to psychotic phenomena, in the context of victimisation exposure, with no studies considering the effects of poly-victimisation. This thesis will utilise a rich data-set from a large prospective longitudinal cohort study which will allow a wide range of individual, family and community-level protective factors to be considered in relation to psychotic phenomena during both childhood and adolescence amongst individuals exposed to multiple forms of victimisation. This thesis will thus address a major gap in the current literature and will have important practical implications for intervention efforts targeting psychotic phenomena.

## Chapter 3: Methodology

### 3.1 Environmental Risk (E-Risk) Longitudinal Twin Study

Participants are members of the Environmental Risk (E-Risk) Longitudinal Twin Study, which investigates how genetic and environmental factors shape children's development. The sampling frame from which the E-Risk families were drawn was two consecutive birth cohorts (1994 and 1995) in a birth register of twins born in England and Wales (Trouton, Spinath, & Plomin, 2002). Of the 15,906 twin pairs born in these two years, 71% joined the register.

The E-Risk Study probability sample was drawn using a high-risk stratification strategy. High-risk families were those in which the mother had her first birth when she was 20 years of age or younger. This sampling frame was used (1) to replace high risk families who were selectively lost to the register via non-response and (2) to ensure sufficient base rates of environmental risk factors. Age at first childbearing was used as the risk-stratification variable because it was present for virtually all families in the register, it is relatively free of measurement error, and early childbearing is associated with a host of other difficulties and is a known risk factor for children's problem behaviours (Maynard, 1997; Moffitt & The E-Risk Study Team, 2002). The high-risk sampling strategy resulted in a final sample in which one-third of Study mothers constitute a 160% oversample of mothers who were at high risk based on their young age at first birth (13–20 years), while the other two-thirds of Study mothers accurately represent all mothers in the general population (13–48 years) in England and Wales in 1994–95 based on estimates derived from the General Household Survey (Bennett, Jarvis, Rowlands, Singleton, & Haselden, 1996).

The Study sought a sample size of 1,100 families to allow for attrition in future years of the longitudinal study while retaining statistical power. An initial list of families who had same-sex twins was drawn from the register to target for home-visits, with a 10% oversample to allow for nonparticipation. Same-sex twin pairs were selected to simplify twin analyses. Of the 1,203 families from the initial list who were eligible for inclusion, 1,116 (93%) participated in home-visit assessments when the twins were age 5 years, forming the base sample for the study (2,232 children): 4% of families refused, and 3% were lost to tracing or could not be reached after many attempts. With parent's permission, questionnaires were posted to the children's teachers, and teachers returned questionnaires for 94% of cohort children. Zygosity was determined using a standard zygosity questionnaire, which has been shown to have 95% accuracy (Price et al., 2000). Ambiguous cases were zygosity-typed using



DNA. Subsequently, all participants who provided a DNA sample at any point across the study phases (97%) have been genotyped and had their zygosity checked. The sample includes 56% monozygotic (MZ) and 44% dizygotic (DZ) twin pairs. Sex is evenly distributed within zygosity (49% male). All families are English speaking, and the majority (93.7%) are White. E-Risk families are representative of UK households across the spectrum of neighbourhood-level deprivation: 25.6% of E-Risk families live in “wealthy achiever” neighbourhoods compared to 25.3% of households nation-wide; 5.3% vs 11.6% live in “urban prosperity” neighbourhoods; 29.6% vs 26.9% live in “comfortably off” neighbourhoods; 13.4% vs 13.9% live in “moderate means” neighbourhoods; and 26.1% vs 20.7% live in “hard-pressed” neighbourhoods (CACI, 2006; Caspi, Taylor, Moffitt, & Plomin, 2000). E-Risk families under-represent “urban prosperity” neighbourhoods because such households are likely to be childless.

Attrition has been minimal, and data has been successfully collected from 98% (at age 7 years), 96% (at age 10 years), 96% (at age 12 years), and most recently in 2012–2014, 93% of the original sample (at age 18 years). Home-visits at ages 5, 7, 10, and 12 years included face-to-face assessments with participants as well as their mother (or primary caregiver); the home-visit at age 18 included interviews only with the participants, and questionnaires completed by co-informants (caregivers and other family members). Each twin participant was assessed by a different interviewer. The average age of the twins at the time of the age 18 assessment was 18.4 years ( $SD=0.36$ ); all interviews were conducted after the 18<sup>th</sup> birthday. There were no differences between those who did and did not take part at age 18 in terms of socioeconomic status (SES) assessed when the cohort was initially defined ( $\chi^2=0.86$ ,  $p=0.65$ ), age-5 IQ scores ( $t=0.98$ ,  $p=0.33$ ), or age-5 internalizing or externalizing behaviour problems ( $t=0.40$ ,  $p=0.69$  and  $t=0.41$ ,  $p=0.68$ , respectively).

The Joint South London and Maudsley and the Institute of Psychiatry Research Ethics Committee approved each phase of the study. Parents gave informed written consent at ages 5–12. Participants gave assent at ages 5–12 and informed written consent at age 18.

## **3.2 Measures**

### **3.2.1 Psychotic phenomena**

The research presented in this thesis utilises two measures of early psychotic phenomena that were obtained at two time-points, firstly at age 12 (childhood) and secondly at age 18 (adolescence). At both ages 12 and 18, the prevalence of psychotic symptoms was measured via face-to-face structured interviews that were verified by clinicians to obtain an estimate of more clinically pertinent psychotic phenomena. At age 18, psychotic experiences were additionally measured, using responses to the face-to-face structured interview, but without clinical verification. This broader estimate of self-reported psychotic phenomena reflects the methodology used by many groups in the psychosis prodrome research field (Loewy, Pearson, Vinogradov, Bearden, & Cannon, 2011) and therefore increases the comparability of this research with that from other groups. In addition, previous research has shown that such self-report screening measures, particularly of delusions and hallucinations, have reasonable predictive value for identifying adolescents who meet clinical interview criteria for definite psychotic phenomena (Kelleher, Harley, Murtagh, & Cannon, 2011).

#### *3.2.1.1 Psychotic symptoms*

E-Risk families were visited by mental health trainees or professionals when children were aged 12. Interviewers had no prior knowledge about the child. Different staff members interviewed the child's parents. Each child was privately interviewed about seven psychotic symptoms they may have experienced throughout childhood, with items pertaining to delusions and hallucinations:

1. Have other people ever read your thoughts?
2. Have you ever believed that you were being sent special messages through the television or radio, or that a programme has been arranged just for you alone?
3. Have you ever thought you were being followed or spied on?
4. Have you ever heard voices that other people cannot hear?
5. Have you ever felt like you were under the control of some special power?
6. Have you ever known what another person was thinking, like you could read their mind?
7. Have you ever seen something or someone that other people could not see?

If an item was positively endorsed, then the interviewer asked follow-up questions to obtain more information about the experience and wrote detailed notes based on the participant's description of the symptom. Interviewers then coded each experience 0, 1, 2 indicating respectively "not present", "probably present", and "definitely present". This interview has been described in detail previously (Polanczyk et al., 2010). The item choice was guided by the Dunedin Study's age-11 interview protocol (Poulton et al., 2000) and an instrument prepared for the Avon Longitudinal Study of Parents and Children (Schreier et al., 2009). A conservative approach was taken in designating a child's report as a symptom. First, the interviewer probed using standard prompts designed to discriminate between experiences that were plausible (e.g., "I was followed by a man after school") and potential symptoms (e.g., "I was followed by an angel who guards my spirit"), and wrote down the child's narrative description of the experience. Second, items and interviewer notes were assessed by a psychiatrist expert in schizophrenia, a psychologist expert in interviewing children, and a child and adolescent psychiatrist to verify the validity of the symptoms (but without consulting other data sources about the child or family). Third, because children were twins, experiences limited to the twin relationship (e.g., "My twin and I often know what each other are thinking") were coded as "not a symptom". Children were only designated as experiencing psychotic symptoms if they reported at least one definite, clinically-verified symptom. At age 12, 5.9% (N=125) of children reported experiencing psychotic symptoms (referred to as childhood psychotic symptoms in this thesis).

The same items and clinical verification procedure was used when participants were interviewed at age 18, this time enquiring about psychotic symptoms they may have experienced since age 12. At age 18, 2.9% (N=59) of participants reported experiencing psychotic symptoms since age 12 (referred to as adolescent psychotic symptoms in this thesis). These rates are similar to those reported for community samples of children and adolescents in other studies using clinical verification procedures (Dhossche, Ferdinand, van der Ende, Horwood et al., 2008). The comparatively low prevalence of psychotic symptoms at age 18 versus age 12 is also consistent with findings from other studies showing an attenuating rate of psychotic symptoms from childhood to adulthood (Kelleher et al., 2012c; Zammit et al., 2013a). Furthermore, psychotic symptoms in this cohort have previously been shown to have good construct validity, sharing many of the same genetic, social, neurodevelopmental, and behavioural risk factors and correlates as adult psychotic disorders (Polanczyk et al., 2010).

### 3.2.1.2 *Psychotic experiences*

During the age 18 interviews, participants were asked six items about unusual feelings and thoughts in addition to the seven hallucination/delusion items detailed above. These items drew on item pools since formalised in prodromal psychosis screening instruments including the Prevention through Risk Identification, Management and Education (PRIME)-screen (Miller, Cicchetti, Markovich, McGlashan, & Woods, 2004) and the Structured Interview for Psychosis-Risk Syndromes (SIPS) (Miller et al., 2003). These additional items were:

1. I have become more sensitive to lights or sounds
2. I feel as though I can't trust anyone
3. I worry that my food may be poisoned
4. People or places I know seem different
5. I believe I have special abilities or powers beyond my natural talents
6. My thinking is unusual or frightening

Interviewers coded each of the 13 items 0, 1, 2, indicating respectively “not present”, “probably present” and “definitely present”. Responses to each of the 13 items (none, probable, definite) were summed to create a psychotic experiences scale (potential range=0–26, actual range=0–18,  $M=1.19$ ,  $SD=2.58$ ). The psychotic experiences measure did not involve clinical verification, meaning that this is a self-report measure capturing a broader range of mild, moderate and potentially clinically pertinent hallucinations, delusions, and other unusual feelings and thoughts (referred to as adolescent psychotic experiences in this thesis). Since there were low numbers of adolescents with high psychotic experiences scores (e.g., only 1.0% [ $N=21$ ] of participants reported 13 or more psychotic experiences), scores were placed into an ordinal scale to tackle the skewed distribution. Just over 30% of participants had at least one psychotic experience between ages 12 and 18: 69.8% reported no psychotic experiences (coded 0;  $N=1,440$ ), 15.5% reported 1 or 2 psychotic experiences (coded 1;  $N=319$ ), 8.1% reported 3–5 psychotic experiences (coded 2:  $N=166$ ), and 6.7% reported 6 or more psychotic experiences (coded 3:  $N=138$ ). This 30.2% prevalence is similar to the prevalence of self-reported psychotic experiences in other community samples of teenagers and young adults (Spauwen, Krabbendam, Lieb, Wittchen, & van Os, 2004; Yoshizumi, Murase, Honjo, Kaneko, & Murakami, 2004; Yung et al., 2009). In Chapters 5 and 6 the measure was collapsed into a binary variable with those who do not have psychotic experiences ( $N=1,440$ ) vs. those who reported one or more psychotic experiences ( $N=623$ ). This variable was dichotomised because the focus of the empirical

chapters was on those who did not have psychotic experiences and therefore a binary variable was appropriate for this distinction to be made (absent vs. present).

### 3.2.2 Poly-victimisation

#### 3.2.2.1 *Childhood poly-victimisation*

Exposure to several types of victimisation was assessed repeatedly when the children were 5, 7, 10, and 12 years of age and dossiers have been compiled for each child with cumulative information about exposure to domestic violence between the mother and her partner; frequent bullying by peers; physical maltreatment by an adult; sexual abuse; emotional abuse and neglect; and physical neglect. The E-Risk cohort has previously reported evidence on the reliability and validity of the measures of domestic violence (Moffitt et al., 1997), bullying (Arseneault et al., 2006; Shakoor et al., 2011), physical maltreatment and sexual abuse (Jaffee, Caspi, Moffitt, & Taylor, 2004), emotional abuse and neglect (Danese et al., 2017), and physical neglect (Fisher et al., 2015). All the component measures are outlined below.

*Physical Domestic Violence.* Mothers reported about perpetration of and victimisation by 12 forms of physical violence (e.g., slapping, hitting, kicking, strangling) from the Conflict Tactics Scale (Straus, 1990), on three assessment occasions during the child's first decade of life (when the children were 5, 7, and 10 years of age). Reports of either perpetration or victimisation constituted evidence of physical domestic violence. Families in which no physical violence took place were coded as 0 (55.2%); families in which physical violence took place on one occasion were coded as 1 (28.0%); and families in which physical violence took place on multiple occasions were coded as 2 (16.8%).

*Bullying by peers.* Experiences of victimisation by bullies were assessed using both mothers' and children's reports. During the interview, the following standard definition of bullying was read out: "Someone is being bullied when another child (a) says mean and hurtful things, makes fun, or calls a person mean and hurtful names; (b) completely ignores or excludes someone from their group of friends or leaves them out on purpose; (c) hits, kicks, or shoves a person, or locks them in a room; (d) tells lies or spreads rumours about them; and (e) other hurtful things like these. We call it bullying when these things happen often, and when it is difficult to make it stop. We do not call it bullying when it is done in a friendly or playful way." Mothers were interviewed when children were 7, 10, and 12 years old and asked whether either twin had been bullied by another child, responding never, yes,

or frequently. Mothers' reports when children were age 7 and 10 were combined to derive a measure of victimisation during primary school. Mothers' reports when the children were 12 years old indexed victimisation during secondary school. During private interviews with the children when they were 12 years old, the children indicated whether they had been bullied by another child during primary or secondary school. When a mother or a child reported victimisation, the interviewer asked them to describe what happened. Notes taken by the interviewers were later checked by an independent rater to verify that the events reported could be classified as instances of bullying operationally defined as evidence of (a) repeated harmful actions, (b) between children, and (c) where there is a power differential between the bully and the victim (Shakoor et al., 2011). Although inter-rater reliability between mothers and children was only modest ( $\kappa = 0.20-0.29$ ), reports of victimisation from both informants were similarly associated with children's emotional and behavioural problems, suggesting that each informant provides a unique but meaningful perspective on bullying involvement (Shakoor et al., 2011). This explains why mother and child reports of victimisation were combined to capture all instances of bullying victimisation for primary and secondary school separately: reported as not victimised by both mother and child; reported by either mother or child as being occasionally victimised; and reported as being occasionally victimised by both informants or as frequently victimised by either mother or child or both (Bowes et al., 2013). Primary and secondary school ratings were then combined to create a bullying victimisation variable for the entire childhood period (5-12 years). Children who were never bullied in primary or secondary school or occasionally bullied during one of these time periods were coded as 0 (55.5%); children who were occasionally bullied during primary and secondary school, or frequently bullied during one of these time periods were coded as 1 (35.6%); and children who were frequently bullied at both primary and secondary school were coded as 2 (8.9%).

*Physical and sexual harm by an adult.* Childhood physical and sexual harm in the E-Risk Study were assessed using an approach that resembles the process undertaken by child protection agencies. Essentially this is a two-stage process. In child protection, professionals such as teachers working with children typically raise concerns if they observe signs or symptoms or if they become aware of risk that children are victims of violence. When concerns are raised, child protection officers then review the concerns and evaluate them in the context of information previously gathered on that child or family in order to determine the likelihood that abuse has taken place. In the E-Risk Study, research workers visited the home in pairs, and were extensively trained to detect signs of abuse or neglect. Each time

the two research workers visited a home, they interviewed the mother using a structured interview about child harm, tested the children, and observed the family environment using the Home Observation for Measurement of the Environment (HOME) (Bradley & Caldwell, 1977). If either research worker had any concerns, they flagged up the case for review. Immediately after each home visit, a review was performed if a family was flagged. In addition, at each wave, any family who had been flagged on a prior wave of the study was automatically reviewed again. The reviews were performed independently by at least 2 clinical psychologists or psychiatrists, and were based on comprehensive dossiers compiled across multiple home visits for each study member during the course of the ongoing longitudinal study.

At age 5, assessments were based on the standardised clinical protocol from the MultiSite Child Development Project (Dodge, Bates, & Pettit, 1990; Landsford et al., 2002). At ages 7, 10, and 12 this interview was modified to expand its coverage of contexts for child harm. Interviews were designed to enhance mothers' comfort with reporting valid child maltreatment information, while also meeting researchers' responsibilities for referral under the UK Children Act. Specifically, mothers were asked whether either of their twins had been intentionally harmed (physically or sexually) by an adult or had contact with welfare agencies. If caregivers endorsed a question, research workers made extensive notes on what had happened, and indicated whether physical and/or psychological harm had occurred. Under the U.K. Children Act, our responsibility was to secure intervention if maltreatment was current and ongoing. Such intervention on behalf of E-Risk families was carried out with parental cooperation in all but one case. No families left the study following intervention.

Over the years of data collection, the study developed a cumulative profile for each child, comprising the caregiver reports, recorded debriefings with research workers who had coded any indication of maltreatment at any of the successive home visits, recorded narratives of the successive caregiver interviews, and information from clinicians whenever the Study team made a child-protection referral. Each time research workers visited a home, they flagged concerns, and if there was sufficient evidence to code definite harm then, they did so. If evidence only met the level of probable harm, they kept an "ongoing concern list" and if, at a later wave, there was continued evidence of probable harm, or new evidence, the code was upgraded to definite harm. The profiles were reviewed at the end of the age-12 phase by at least two clinical psychologists or psychiatrists. Initial inter-rater agreement between the coders was 90% in cases for whom maltreatment was identified (100% for cases of sexual abuse), and discrepantly coded cases were resolved by consensus review. These

were coded as: 0 = no physical harm at any age; 1 = probable physical harm at any age; and 2 = definite physical harm at any age. There were 15.0% of children coded as probably being exposed to physical harm and 5.1% as definitely physically harmed by 12 years of age. There were 1.5% of the children coded as being exposed to sexual abuse.

*Emotional abuse and neglect.* These forms of maltreatment were coded from research workers' narratives of the home visits at ages 5, 7, 10, and 12. They coded quite severe examples of parental behaviour observed. For example, a mother who had schizophrenia screamed and swore at the children throughout the home visit. As another example, a father who was drunk during the home visit repeatedly spoke abusively to the children in front of the research workers. The cohort found that coders could not empirically separate emotional abuse and emotional neglect in a reliable way and thus such experiences were coded together as emotional abuse/neglect. Inter-rater agreement between the coders exceeded 85% for cases with emotional abuse and neglect, and discrepant cases were resolved by consensus review. Children with no evidence of emotional abuse/neglect were coded as 0 (88.3%), those where there was some indication of emotionally inappropriate/potentially abusive or neglectful behaviour were coded as 1 (8.7%), and where there was evidence of severe emotional abuse/neglect the children were coded as 2 (3.0%).

*Physical neglect.* The cumulative observations of the physical state of the home environment documented by the research workers during home visits to the twins at ages 5, 7, 10 and 12 were reviewed by two raters for evidence of physical neglect. This was defined as any sign that the caretaker was not providing a safe, sanitary, or healthy environment for the child. This included the child not having proper clothing or food, as well as grossly unsanitary home environments. (However, this did not include a family living in a crime-ridden neighbourhood for economic reasons.) Inter-rater agreement between the coders exceeded 85%, and discrepantly coded cases were resolved by consensus review. Children with no evidence of physical neglect were coded as 0 (90.9%), those for whom there was an indication of minor physical neglect were coded as 1 (7.1%), and where there was evidence of severe physical neglect the children were coded as 2 (2.0%).

*Childhood poly-victimisation.* The E-Risk poly-victimisation variable was derived by summing all victimisation experiences that received a code of '2': 73.5% of children had zero victimisation experiences; 20.1% had 1 victimisation experience; 3.8% had 2 victimisation experiences; 1.8% had 3 victimisation experiences; 0.8% had 4 victimisation experiences; and 0.1% had 5 victimisation experiences. For the analysis in Chapter 4, the childhood poly-



victimisation variable was dichotomised into two groups, those children having zero or one victimisation experience (N = 1987, 93.4%), and those who had 2 or more victimisation experiences (N = 140, 6.6%), who had completed the psychotic symptoms' interview at age 12 in order to run analyses specifically on the poly-victimised group.

#### *3.2.2.2 Adolescent poly-victimisation*

At age 18, participants were interviewed about exposure to a range of victimisation experiences between 12 and 18 years of age using the Juvenile Victimization Questionnaire 2<sup>nd</sup> revision (JVQ-R2) (Finkelhor, Hamby, Turner, & Ormrod, 2011), adapted as a clinical interview. The JVQ has good psychometric properties (Finkelhor, Hamby, Ormrod, & Turner, 2005) and was used in the U.K. National Society for the Prevention of Cruelty to Children national survey (Radford, Corral, Bradley, & Fisher, 2013), thereby providing benchmark values for comparisons with the E-Risk cohort. This adapted version of the JVQ-R2 has been shown to have good reliability and validity (Fisher et al., 2015) and is described in detail below.

Within each pair of twins in our cohort, co-twins were interviewed separately by a different research worker and were assured of the confidentiality of their responses. The participants were advised that confidentiality would only be broken if they told the research worker that they were in immediate danger of being hurt, and in such situations the project leader would be informed and would contact the participant to discuss a plan for safety. We assessed 7 different forms of victimisation: maltreatment, neglect, sexual victimisation, family violence, peer/sibling victimisation, internet/mobile phone victimisation, and crime victimisation. Each JVQ question was asked for the period 'since you were 12'. Participants were given the option to say "yes" or "no" as to whether each type of victimisation had occurred in the reporting period. Research workers could rate each item "maybe" if the participant seemed unsure or hesitant in their response or they were not convinced that the participant understood the question or was paying attention. Items rated as "maybe" were recoded as "no" or "yes" by the rating team based on the notes provided by the research workers. When insufficient notes were available, these responses were recoded conservatively as a "no". Consistent with the JVQ manual (Hamby, Finkelhor, Ormrod, & Turner, 2004; Finkelhor et al., 2011), participants were coded as 1 if they reported any experience within each type of victimisation category, or 0 if none of the experiences within the category were endorsed. If an experience was endorsed within a victimisation category, follow-up questions were asked concerning how old the participant was when it (first)

happened, whether the participant was physically injured in the event, whether the participant was upset or distressed by the event; and how long it went on for (by marking the number of years on a Life History Calendar (Caspi et al., 1996). In addition, the interviewer wrote detailed notes based on the participant's description of the worst event. If multiple experiences were endorsed within a victimisation category, the participant was asked to identify and report about their worst experience.

All information from the JVQ interview was compiled into victimisation dossiers. Using these dossiers, each of the seven victimisation categories was rated by an expert in victimology and 3 other members of the E-Risk team who were trained on using the rating criteria. Ratings were made using a 6-point scale: 0 = not exposed, then 1-5 for increasing levels of severity. The anchor points for these ratings were adapted from the coding system used for the Childhood Experience of Care and Abuse interview (CECA) (Bifulco, Brown, Neubauer, Moran, & Harris, 1994), which has good inter-rater reliability (Bifulco, Brown, Lillie, & Jarvis, 1997). The CECA is a comprehensive semi-structured interview whose standardized coding system attempts to improve the objectivity of ratings by basing them on the coder's perspective (rather than relying on the participant's judgment) and focusing on concrete descriptions rather than perceptions or emotional responses to the questions, together with considering the context in which the adverse experience occurred.

In this adapted coding scheme, the anchor points of the scale differ for each victimisation category, with some focused more on the severity of physical injury that is likely to have been incurred during victimisation exposure (crime victimisation, family violence, maltreatment), while others are more focused on the frequency of occurrence of victimisation (peer/sibling victimisation and internet/mobile phone victimisation), the physical intrusiveness of the event (sexual victimisation), or the pervasiveness of the effects of victimisation (neglect). This reflects the different ways in which severity has previously been defined for different types of victimisation (Barnett, Manly, & Cicchetti, 1993; Bifulco et al., 1994). (Given that our sample comprises twins, we also coded if any of the victimisation events experienced by each twin had been perpetrated by their co-twin, as it is possible that growing up with a genetically related, same-age child could increase or decrease sibling victimisation rates.) Each twin's dossier was evaluated separately, and we did not use information provided in the co-twin's dossier about their own or shared victimisation experiences to rate direct or witnessed violence exposure for the target twin. High levels of inter-rater reliability were achieved for the severity ratings for all forms of victimisation: crime victimisation (intra-class correlation coefficient [ICC] = 0.89,  $p < 0.001$ ), peer/sibling

victimisation (ICC = 0.91,  $p < 0.001$ ), internet/mobile phone victimisation (ICC = 0.90,  $p < 0.001$ ), sexual victimisation (ICC = 0.87,  $p < 0.001$ ), family violence (ICC = 0.93,  $p < 0.001$ ), maltreatment (ICC = 0.90,  $p < 0.001$ ), and neglect (ICC = 0.74,  $p < 0.001$ ).

The ratings for each type of victimisation were then grouped into three classes: 0 – no exposure (score of 0), 1 – some exposure (score of 1, 2 or 3), and 2 – severe exposure (score of 4 or 5) due to small numbers for some of the rating points. Combining ratings of 4 and 5 is also consistent with previous studies using the CECA, which have collapsed comparable scale values to indicate presence of ‘severe’ abuse (Bifulco et al., 1994; Bifulco, Brown, Moran, Ball, & Campbell, 1998; Fisher, Bunn, Jacob, Moran, & Bifulco, 2011). The adolescent poly-victimisation variable was derived by summing all victimisation experiences that received a code of ‘4’ or ‘5’ (i.e., severe exposure): 64.6% of adolescents had zero severe victimisation experiences; 19.2% had 1; 9.4% had 2; 4.5% had 3; 1.5% had 4; 0.5% had 5; and 0.2% had 6 severe victimisation experiences. Due to small numbers in some of the groups, this variable was collapsed into ‘0’ not victimised, ‘1’ experienced 1 type of severe victimisation, and ‘2’ poly-victimised (experienced 2 or more types of severe victimisation). For the analysis in Chapters 5 and 6, this poly-victimisation variable was dichotomised into two groups, those children having zero or one victimisation experience ( $N = 1987$ , 83.8%) and those who had 2 or more victimisation experiences ( $N = 334$ , 16.2%), to enable analyses to be conducted specifically in the poly-victimised group only.

### 3.2.3 Childhood Protective Factors

#### 3.2.3.1 IQ

At age 5, the Wechsler Preschool and Primary Scale of Intelligence Revised (WPPSI; Wechsler, 1990) was used to assess IQ. Children were administered two subtests (Vocabulary and Block Design), and IQ scores were prorated following procedures described previously (Sattler, 1992) and then standardised with a mean of 100 and standard deviation of 15.

#### 3.2.3.2 Executive functioning

Executive function was measured at age 5 as the mean score of 3 separate tasks: Mazes, a WPPSI subtest (Grodzinsky & Diamond, 1992); Day-Night, a nonverbal analog of the Stroop task (Gerstadt, Hong, & Diamond, 1994); and Sentence Working Memory, based on the Baddeley model of working memory (Baddeley, 1996); after converting each scale to a

common metric. The resulting combined score was standardised with a mean of 100 and standard deviation of 15.

#### *3.2.3.3 Temperament*

After the age-5 home visits, research workers rated each twin on 25 different behavioural characteristics which assessed children's style of approach and response to the testing session. The behavioural characteristics were derived from scales initially used to rate children enrolled in the American Collaborative Study on Cerebral Palsy, Mental Retardation, and Other Neurological Disorders of Infancy and Childhood (Goldsmith & Gottesman, 1981), and were modified for use in the Dunedin Health and Development Study (Caspi, Henry, McGee, Moffitt, & Silva, 1995; Henry, 1999). A range of different temperament measures were derived including negative affect, impulsivity, approach, sluggishness, wariness, under-controlled, inhibited and shy. Chapter 4 uses the measure 'approach', this temperament measure was made up of 6 items including: quick adjustment, friendliness, self-confidence, talkativeness, easy separation, and smiling and laughter (internal consistency:  $\alpha=0.90$ ). This measure was selected because extraversion has been associated with resilience (Campbell-Sills, Cohan, & Stein, 2006) and the approach measure was considered to be the closest match to a childhood extroversion measure. Furthermore, this measure captures contrasting traits to those associated with the broader psychosis phenotype (Nitzburg et al., 2016).

#### *3.2.3.4 Pro-social behaviour*

Pro-social behaviour was derived using ten items from the Revised Rutter Parent Scale for School-Age Children (Sclare, 1997) to extract a prosocial score where the items were summed (Goodman, 1994) for children at age 5 (internal consistency:  $\alpha=0.77$ ). Items included: "considerate of other people's feelings", "kind to younger children", and "shares out treats with friends". Questionnaires were completed by both mothers and teachers; the total scores were combined and then averaged to provide a single score.

#### *3.2.3.5 Maternal warmth*

Maternal warmth was assessed using procedures adapted from the Five Minute Speech Sample method (Magaña et al., 1986). Mothers were asked to speak for 5 minutes about each of their children when they were aged 5 and again at age 10. Warmth was coded on a 6-point scale from no warmth (complete absence of warmth) to high warmth (definite warmth, enthusiasm, interest in, and enjoyment of the child). Two trained raters, blind to all

other E-Risk Study data, coded the tapes of the mothers' speech sample (inter-rater agreement:  $r=.90$ ). The maternal warmth scores at ages 5 and 10 were combined, as they were significantly correlated ( $r=0.37$ ,  $P<0.001$ ), and then averaged to provide a single score.

#### *3.2.3.6 Sibling warmth*

Mothers were asked a series of questions about the quality of their children's relationship with one another when the children were aged 7 and 10 (Jaffee, Caspi, Moffitt, Polo-Tomás, & Taylor, 2007). Mothers responded on a 3-point scale to six questions (e.g., 'do your twins love each other,' 'do both your twins do nice things for each other'). The internal consistency reliability score at age 7 was 0.77 and at age 10 was 0.80. The sibling warmth scores at ages 7 and 10 were combined, as they were significantly correlated ( $r=0.57$ ,  $P<0.001$ ), and then averaged to provide a single score.

#### *3.2.3.7 Atmosphere at home*

The creation of the atmosphere at home measure has been previously documented (Kim-Cohen et al., 2006). It was derived from the Coder's Impression Inventory, which is based on the Home Observation for Measurement of the Environment (HOME) (Bradley & Caldwell, 1977) and the University of Washington Parenting Clinic Questionnaire (Parent-Child Observations) (Webster-Stratton, 1998). The Coder's Impression Inventory was rated immediately following the study visit at ages 7 and 10 by interviewers who had undergone four-day training. This measure comprised items representing the state of the home (e.g., 'Are visible rooms of the house clean?'), stimulation (e.g., 'Is the children's art displayed in the home?'), happiness (e.g., 'Is this a happy home?') and chaos (e.g., 'Is the house chaotic or overly noisy?'). The internal consistency at age 7 was  $\alpha=.77$ , and  $\alpha=0.79$  at age 10. In Chapter 4, the average of the overall atmosphere at home scores at ages 7 and 10 was used for analysis as they were significantly correlated ( $r=0.64$ ,  $P<0.001$ ).

#### *3.2.3.8 Social cohesion*

At age 5, the children's mothers (or primary caregivers) reported on their immediate neighbourhood during the face-to-face interviews. Mothers were asked five questions, including "is this a close-knit neighbourhood", "do you think people in this neighbourhood can be trusted", "do you share the same values", "do you generally get along with each other" and "are people willing to help their neighbours". Each item was coded 0-4 and a total

score was derived by summing the answers to all 5 questions (internal consistency:  $\alpha=.83$ ), with higher total scores indicative of greater social cohesion.

#### *3.2.3.9 Supportive adult*

The presence of a supportive adult was assessed at age 12 when children were asked questions about whether they had a stable adult figure to rely on for basic needs and support (e.g., “there is an adult who I can tell almost anything to”, “there is an adult who I can go to if I am in trouble”). Participants answered not true (0), sometimes true (1), or true (2). A total score was derived by summing responses to 13 items (internal consistency:  $\alpha=.85$ ). The questions did not ask the child to specify who the adult was and thus this could have been someone within or outside of their family.

#### *3.2.4 Adolescent Protective Factors*

##### *3.2.4.1 IQ*

At age 12, the Wechsler Intelligence Scale for Children (WISC) (Wechsler, 2003) was used to assess IQ. Participants were administered 3 tasks: matrix reasoning, information and digit span. Again, the three scores were combined to create an overall scale and then standardised with a mean of 100 and standard deviation of 15.

##### *3.2.4.2 Physical activity*







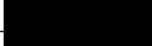



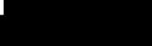

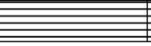
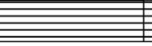
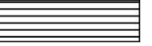





At age 18, participants completed the Stanford Brief Activity Survey (SBAS; Stanford University, 2001). The SBAS contains 2 items. For item 1 participants were asked “which statement best describes the kinds of physical activity you usually perform at work, school or college”:

- a. Not applicable (option for individuals not in education or regular work)
- b. I spend most of the day sitting or standing (e.g. talking on the phone, typing, writing)
- c. I spend most of the day walking or using my hands and arms in work that requires moderate effort (e.g. operating machines, house painting)
- d. I spend most of the day lifting or carrying heavy objects or moving my body in some other way (e.g. stacking foods, gardening, handling materials)
- e. I spend most of the day doing hard physical labour (e.g. digging, chopping, carrying heavy loads)

Next, item 2 asked participants to select “the one statement which best describes the way you spend your leisure time”. The response options were:

- f. Most of my leisure time is spent without very much physical activity (e.g. watching television, reading, playing on my phone)
- g. When I get home during the week, I do few active things, but most weekends I get outdoors for some light exercise (e.g. walking, active chores around the house)
- h. Three times per week on average, I take part in some moderate activity (e.g. jogging, brisk walking, riding a bike for 15-20 minutes)
- i. During my leisure time, I take part in regular fitness progress involving some kind of heavy physical activity (e.g. running, riding fast on a bike for 30 minutes+)
- j. I engage in physical fitness involving some kind of heavy physical activity but I do this almost everyday

The responses to each item are then cross checked against the below grid (Figure 3.1) to derive an overall activity measure (Taylor-Piliae et al., 2010), resulting in a 5-point scale: inactive, low intensity, moderate intensity, hard intensity and very hard intensity. In Chapter 5, a binary variable is used for the analyses, creating two groups: those who were inactive (rating of 1) vs. those who were active (rating of 2–5). This variable was dichotomised to distinguish between those who engaged in any level of physical activity compared to those who were not physically active.

		Leisure-time activity (F-J)				
On-the-job activity (A-E)		F	G	H	I	J
	A					
	B					
	C					
	D					
	E					

**Figure 3.1: Stanford Brief Activity Survey Scoring Criteria.** Inactive (1) = vertical lines; light-intensity activity (2) = trellis pattern; moderate-intensity activity (3) = solid white; hard-intensity activity (4) = solid black; and very hard-intensity activity (5) = horizontal lines.

#### 3.2.4.3 Coping strategies

Coping was assessed at age 18 by asking participants about which strategies they used when experiencing stress in relation to finances, relationships, college, or work. The scale comprises 15 items and participants rated each item as “not true” (0), “somewhat true” (1), or “very true” (2). The scores for the four items reflecting positively-worded coping strategies

(“talk with other people about it”, “talk with a therapist or counsellor”, “exercise” and “take steps to solve the problem”) were combined to create an overall scale (potential range from 0-8) with higher scores reflecting more positive coping strategies.

#### *3.2.4.4 Atmosphere at home*

The creation of the atmosphere at home measure has been previously documented (Kim-Cohen et al., 2006). It was derived from the Coder’s Impression Inventory, which is based on the Home Observation for Measurement of the Environment (HOME) (Bradley & Caldwell, 1977) and the University of Washington Parenting Clinic Questionnaire (Parent–Child Observations) (Webster-Stratton, 1998). The Coder’s Impression Inventory was rated immediately following the study visit at age 12 by interviewers who had undergone four-day training. This measure comprised items representing the state of the home (e.g., ‘Are visible rooms of the house clean?’), stimulation (e.g., ‘Is the children’s art displayed in the home?’), happiness (e.g., ‘Is this a happy home?’) and chaos (e.g., ‘Is the house chaotic or overly noisy?’). In Chapter 5 the four sub-scales from the age 12 visit were used (internal consistency was  $\alpha=.76$ ).

#### *3.2.4.5 Social cohesion*

Residents living alongside the E-Risk children reported on their neighbourhoods in a resident survey when the children were aged 13–14 (Odgers et al., 2009; Odgers et al., 2012). The objective was to obtain multiple reporters (e.g., 2 or more) for each family’s neighbourhood (here defined to the street or apartment block level). Questionnaires were sent to every household in the same postcode as the E-Risk families, excluding the E-Risk families themselves (addresses were identified from electoral roll records). The number of surveys sent per postcode ranged from 15 to 50 residences per neighbourhood (Average=18.96, SE=0.21). Excluding undelivered surveys (N=600), the overall response rate was 28.1% (5601/19926), similar to that previously found (Messner, Baumer, & Rosenfeld, 2004). Survey respondents typically lived on the same street or within the same apartment block as the children in our study. Surveys were returned by an average of 5.18 (SD=2.73) respondents per neighbourhood (range=0–18 respondents). There were at least three responses for 80% of neighbourhoods and at least two responses from 95% of the neighbourhoods (N=5,601 respondents) (Odgers et al., 2012). Most respondents had lived in the neighbourhood for more than 5 years (83%), and only 1% of respondents had lived in the neighbourhood for less than 1 year.



Within this survey, social cohesion was measured using 5 items: “is this a close-knit neighbourhood”, “do you think people in this neighbourhood can be trusted”, “do you share the same values”, “do you generally get along with each other” and “are people willing to help their neighbours”. Each item was coded 0-4 by residents and a total score was derived by summing the answers to all 5 questions (internal consistency:  $\alpha=.83$ ), with higher total scores indicative of greater social cohesion.

#### *3.2.4.6 Social support*

Social support was assessed using the Multidimensional Scale of Perceived Social Support (MSPSS), which assesses individuals' access to supportive relationships with family, friends and significant others (Zimet, Powell, Farley, Werkman, & Berkoff, 1988). The 12 items in the MSPSS are outlined below:

1. There is a special person who is around when I am in need
2. There is a special person with whom I can share my joys and sorrows
3. My family really tries to help me
4. I get the emotional support and help I need from my family
5. I have a special person who is a real source of comfort
6. My friends really try to help me
7. I can count on my friends when things go wrong
8. I can talk about my problems with my family
9. I have friends with whom I can share my joys and sorrows
10. There is a special person in my life who cares about my feelings
11. My family is willing to help me make decisions
12. I can talk about my problems with friends

At age 18, participants rated these statements as “not true” (0), “somewhat true” (1) or “very true” (2). Scores were summed to produce an overall social support scale with higher scores reflecting greater social support (internal consistency:  $\alpha=0.88$ ). Chapters 5 and 6 considers total social support in addition to each of the three sub-scales (support from friends, family, and significant others) separately in the analyses.

### 3.2.5 Confounders

#### 3.2.5.1 *Other childhood mental health problems*

Chapters 4, 5, and 6 incorporate childhood mental health problems in the analyses. Chapter 4 considers whether children exposed to poly-victimisation who do not have psychotic symptoms are at elevated risk for other mental health problems in childhood, whilst Chapters 5 and 6 control for earlier mental health problems (as well as childhood psychotic symptoms) when investigating protective factors for psychotic experiences in adolescence.

The variable for mental health problems in childhood included extreme anxiety, clinically-relevant depression, attention deficit hyperactivity disorder (ADHD), and conduct disorder. Anxiety was assessed when children were aged 12, via private interviews using the 10-item version of the Multidimensional Anxiety Scale for Children (MASC) (March, Parker, Sullivan, Stallings, & Conners, 1997). This self-report scale measures a wide spectrum of anxiety symptoms, corresponding with diagnostic criteria for social phobia, separation anxiety, selective mutism, and generalised anxiety disorder. Each of the 10 items were graded in severity (0–2), with a total score range of 0 to 18 ( $M=7.62$ ,  $SD=3.04$ ) in this sample. The internal consistency reliability of this scale was 0.63 (Bowes et al., 2013). Children scoring at or above the 95th centile (raw score of 13 or more) constitute the childhood anxiety group ( $N=129$ , 6.1%) in this thesis. Depression symptoms were assessed at age 12 during the private interviews using the Children’s Depression Inventory (CDI) (Kovacs, 1992). The CDI is a 27-item scale assessing several aspects of depression including negative mood, negative self-esteem, anhedonia, ineffectiveness, and interpersonal problems. Children who scored 20 or more (Rivera, Bernal, & Rosello, 2005) were deemed to have clinically significant depressive symptoms ( $N=74$ , 3.5%) and constitute the childhood depression group in this thesis. ADHD was assessed using the DSM-IV and the requirement of symptom onset prior to age 12 was met if parents or teachers reported more than 2 ADHD symptoms at ages 5, 7, 10, or 12 years. Conduct disorder was assessed at age 12 using the Achenbach’s family instrument (Achenbach, 1991), the most widely used and well-validated assessment scheme for assessing antisocial behaviour problems among children and adolescents. Both mothers’ and teachers’ reports of the children’s delinquent and aggressive behaviours were combined by summing items from each rater (scored 0–2). An extreme conduct disorder group was formed with children who scored at or above the 95th centile ( $N=110$ , 5.1%) (Odgers, Donley, Caspi, Bates, & Moffitt, 2015). For use as a confounder, a ‘childhood mental health problems’ variable was derived to distinguish between the presence of any of the above mental health

problems (coded 1) versus the absence of all of these age-12 mental health problems (coded as 0).

### *3.2.5.2 Family-level covariates*

Analyses in Chapters 4, 5, and 6 adjust for key family-level factors that might simultaneously influence both the protective factors such as IQ and social support and also the likelihood of developing psychotic phenomena, including family SES and family psychiatric history. Family SES was measured at age 5 via a composite of parental income, parental education, and parental occupation: parental income was measured as the entire income of the household; parental education was the highest level of education achieved by either the mother or father (highest value taken), ranging from 1 (CSE [1], O Level [A-C], GCSE [A-C]) to 7 (postgraduate degree); parental occupation was the highest level of parental occupation of either parent, ranging from 1 (both parents unemployed [coded 2 if single unemployed mother]) to 9 (professional). The three SES indicators were highly correlated ( $r$ 's=0.57–0.67, all  $p$ 's<0.05) and loaded significantly onto one latent factor ( $M$ =2.00,  $SD$ = 0.82; factor loadings=0.80, 0.70 and 0.83 for parental income, education and occupation, respectively). These variables were then standardised and summed, before categorising into tertiles at the 33.33rd and 66.66th centile (low-, medium-, and high-SES) (Trzesniewski, Moffitt, Caspi, Taylor, & Maughan, 2006). Family psychiatric history was measured when children were aged 12 during the face-to-face interviews with the children's mothers. The mother reported on her own mental health history and the mental health history of her biological mother, father, sisters, brothers, as well as the twins' biological father (Weissman et al., 2000). This was converted to the proportion of family members with a history of any psychiatric disorder (Milne et al., 2008) (coded 0–1.0;  $M$ =0.37,  $SD$ =0.27).

## **3.3 Statistical Analysis**

All analyses were conducted in STATA 15 (Stata-Corp, College Station, TX). Chapters 4 and 5 utilise binary logistic regression analyses, whilst Chapter 6 applies generalised estimating equations for discordant twin analyses. The analyses for each chapter are described in detail within the statistical analyses sections of the relevant chapter. The E-Risk cohort is a twin sample and therefore it is necessary to adjust all regression analyses for the within-twin pair correlated nature of the data. That is, observations are correlated between twin siblings, and this violates the assumption of independent residuals. This is accounted for by using the

“CLUSTER” command in STATA, followed by the family (twin pair) identifier variable. This procedure is derived from the Huber-White variance estimator and provides robust standard errors adjusted for within-cluster correlated data (Rogers, 1994).

## **Chapter 4: Protective factors for psychotic symptoms among poly-victimised children**

This study was accepted for publication and therefore this chapter contains an exact copy of the published version.

### **Reference:**

Crush, E., Arseneault, L., Jaffee, S.R., Danese, A., & Fisher H.L. (2018). Protective factors for psychotic symptoms among poly-victimized children. *Schizophrenia Bulletin*, 44(3), 691-700.

## Protective Factors for Psychotic Symptoms Among Poly-victimized Children

Eloise Crush<sup>1</sup>, Louise Arseneault<sup>1</sup>, Sara R. Jaffee<sup>2</sup>, Andrea Danese<sup>1,3,4</sup>, and Helen L. Fisher<sup>\*,1</sup>

<sup>1</sup>MRC Social, Genetic & Developmental Psychiatry Centre, Institute of Psychiatry, Psychology & Neuroscience, King's College London, London, UK; <sup>2</sup>Department of Psychology, University of Pennsylvania, Philadelphia, PA; <sup>3</sup>Department of Child & Adolescent Psychiatry, Institute of Psychiatry, Psychology & Neuroscience, King's College London; <sup>4</sup>National & Specialist CAMHS Trauma and Anxiety Disorders Clinic, South London and Maudsley NHS Foundation Trust, London, UK

\*To whom correspondence should be addressed; tel: +44-207-848-5430, fax: +44-207-848-0866, e-mail: [helen.2.fisher@kcl.ac.uk](mailto:helen.2.fisher@kcl.ac.uk)

**Background:** Experiencing victimization in early life has been repeatedly shown to be associated with the emergence of psychotic symptoms in childhood. However, most victimized children do not develop psychotic symptoms and why this occurs is not fully understood. This study investigated which individual, family-level, and wider community characteristics were associated with an absence of psychotic symptoms among children at risk for psychosis by virtue of their exposure to multiple victimization experiences (poly-victimization). **Methods:** Participants were from the Environmental Risk Longitudinal Twin Study, a nationally representative cohort of 2232 UK-born twins. Exposure to maltreatment, bullying and domestic violence prior to age 12 was determined from interviews with mothers, children, and observations by research workers at ages 5, 7, 10, and 12. Children were interviewed about psychotic symptoms at age 12. Protective factors were measured at ages 5, 7, 10, and 12. **Results:** Childhood poly-victimization was associated with age-12 psychotic symptoms (OR = 4.61, 95% CI 2.82–7.52), but the majority of poly-victimized children did not report symptoms (80.7%). Having a relatively high IQ, more positive atmosphere at home, and higher levels of neighborhood social cohesion were found to be protective against childhood psychotic symptoms among poly-victimized children and also in the whole sample. However, “protected” poly-victimized children displayed elevated levels of other mental health problems compared to nonvictimized children. **Conclusions:** Children’s characteristics, family context, and the wider community were all found to protect children from developing early psychotic symptoms, even when they were victimized multiple times. These findings indicate targets for multilevel preventive interventions.

**Key words:** child abuse/childhood psychotic symptoms/home environment/IQ/resilience/social cohesion

### Introduction

Recent literature has highlighted the presence of psychotic symptoms, such as hallucinations and delusions, in non-clinical populations,<sup>1,2</sup> with around 1 in 20 children from the general population reporting them at 12 years of age.<sup>3</sup> Such early experiences of psychotic symptoms have been shown to not only be distressing for children<sup>4</sup> but also to increase the risk for engaging in suicidal behaviors,<sup>5</sup> and for the development of schizophrenia and other psychiatric disorders in adulthood.<sup>6,7</sup> It is, therefore, important to identify factors that confer protection against the manifestation of psychotic symptoms in childhood.

The vast majority of research to date has focused upon those who develop psychotic symptoms, in order to investigate associated risk factors. Adverse childhood experiences, such as physical or sexual abuse, neglect, bullying by peers, and witnessing domestic violence, appear to be a significant risk factor for the development of psychotic symptoms in childhood.<sup>8–10</sup> For instance, our group previously reported on the association between different individual types of victimization, including maltreatment by an adult and bullying by peers, and the presence of psychotic symptoms in children aged 12.<sup>8</sup> Exposure to more than one type of adversity in childhood (poly-victimization) has been associated with an even greater risk of developing psychotic symptoms.<sup>8,11</sup> While poly-victimization has been implicated as a major risk factor, current research in this area does not address the fact that the majority of victimized children will not develop psychotic symptoms.<sup>8</sup> Furthermore, it does not consider that “protective” factors could have a buffering role. Research on those who do not develop psychotic symptoms would provide valuable insights that could be harnessed to inform both the development and implementation of preventive interventions, particularly among children at risk for psychosis by virtue of their exposure to multiple

victimization experiences (poly-victimized).<sup>12</sup> Therefore, this article aims to identify individual-, family-, and community-level protective factors that are associated with a reduced likelihood of psychotic symptoms developing during childhood among poly-victimized children.

Given the lack of research exploring protective factors for psychotic symptoms, here we draw partly on the risk literature to hypothesize about factors whose absence or inverse may serve to be protective. In terms of individual-level protective factors, cognitive functioning and personality characteristics are potential candidates. It has been well-documented that children in the general population who report psychotic symptoms have a lower IQ<sup>3,13</sup> and also that IQ declines in childhood have been associated with psychotic symptoms in adulthood.<sup>14</sup> These findings suggest that lower IQ may be an expression of a general neurodevelopmental impairment on the pathway to psychosis.<sup>15</sup> Hence, relatively high IQ levels may be protective against the development of psychotic symptoms. We have also previously found that poor executive functioning is associated with an increased risk of psychotic symptoms in children,<sup>3</sup> and thus, average or higher levels of this type of cognitive functioning might be protective.

Personality characteristics, such as being shy and fearful (high harm avoidance), low cooperativeness, and a lack of ability to adapt to situations (low self-directedness), have been shown to be associated with psychotic experiences through to clinical disorder.<sup>16–19</sup> It is, therefore, possible that the opposite personality traits, for example being talkative, engaging in social situations, and having natural confidence in novel situations, may be protective against the development of psychotic phenomena. Indeed, healthy adults were found to have higher persistence (eagerness and ambition) and cooperativeness (social acceptance and empathy) than patients with schizophrenia.<sup>18</sup> These traits may help individuals to overcome adverse experiences, by resisting tendencies toward social withdrawal and increasing the likelihood of seeking help from others, thus protecting them from developing severe mental health problems. Although these findings were not replicated in a childhood sample.<sup>19</sup> Additionally, social behaviors in childhood such as solitary play and social anxiety<sup>20,21</sup> have been established as risk factors among those with a later diagnosis of schizophrenia in adulthood. It is, therefore, plausible that children who show a natural affinity for social interaction and prosocial behaviors may be less likely to develop psychotic symptoms as this may enable them to make stable friendships and develop their own supportive social networks.

Potential protective factors may also be present within the home environment in which children are brought up. A previous study conducted by our group reported that maternal warmth, sibling warmth, and a positive atmosphere at home were protective against internalizing and externalizing problems among children who had been bullied.<sup>22</sup> It is possible that good relationships with family

members and growing up in a nurturing and predictable environment may also be protective against psychotic symptoms among victimized children.

Community factors, outside of the home environment, such as low neighborhood social cohesion<sup>23</sup> have previously been associated with psychotic symptoms emerging in both clinical and non-clinical populations, particularly in the context of victimization exposure.<sup>24</sup> Therefore, living in an area where neighbors trust and get along with each other might be protective against psychotic symptoms emerging, particularly among victimized children perhaps because it increases the likelihood of others intervening if they witness maltreatment or provides more opportunities for victimized children to obtain help.

Reduced levels of social support<sup>25</sup> have also previously been associated with the development of early psychotic symptoms, while having more close relationships has been suggested to protect against psychosis in adulthood.<sup>26</sup> Therefore, having someone to turn for support following victimization could also be protective against the emergence of childhood psychotic symptoms.

This article utilizes prospectively collected data from a large, nationally representative cohort of UK children to explore whether individual (IQ, executive functioning, prosocial behavior, and temperament), family (atmosphere at home, maternal warmth, and sibling warmth), community (social cohesion), or cross-level (supportive adults) factors are associated with a reduced likelihood of developing psychotic symptoms among poly-victimized children. Given that poly-victimization has been associated with a range of mental health problems,<sup>27</sup> we also investigated whether protected children (those exposed to poly-victimization but without childhood psychotic symptoms) were resilient to other mental health problems.

## Methods

### *Study Cohort*

Participants were members of the Environmental Risk (E-Risk) Longitudinal Twin Study, which tracks the development of a nationally representative birth cohort of 2232 British twin children born in England and Wales in 1994–1995. Full details about the sample are reported elsewhere<sup>28</sup> and in the Supplementary Material. Briefly, the E-Risk sample was constructed in 1999–2000, when 1116 families with same-sex 5-year-old twins (93% of those eligible) participated in home-visit assessments. Families were recruited to represent the UK population of families with newborns in the 1990s, based on residential location throughout England and Wales and mothers' age. Teenaged mothers with twins were over-selected to replace high-risk families who were selectively lost to the register through nonresponse. Older mothers having twins via assisted reproduction were underselected to avoid an excess of well-educated older mothers. E-Risk

families are representative of UK households across the spectrum of neighborhood-level deprivation (see online Supplementary Material). The sample comprised 56% monozygotic and 44% dizygotic twin pairs, and sex was evenly distributed within zygosity (49% male). Follow-up home-visits were conducted when children were aged 7, 10, and 12 (participation rates were 98%, 96%, and 96%, respectively). The Joint South London and Maudsley and the Institute of Psychiatry Research Ethics Committee approved each phase of the study. Parents gave informed consent and children gave assent.

### Measures

**Childhood Psychotic Symptoms.** E-Risk families were visited by mental health trainees or professionals when children were aged 12.<sup>3</sup> Each child was privately interviewed about seven psychotic symptoms pertaining to delusions and hallucinations. Items and interviewer notes were assessed by a psychiatrist expert in schizophrenia, a psychologist expert in interviewing children, and a child and adolescent psychiatrist to verify the validity of the symptoms. This interview and coding procedure has been described in detail previously<sup>3</sup> and in Supplementary Material. At age 12, the majority of children in the sample had complete data on psychotic symptoms ( $N = 2127/2146$ , 99.1%). A total of 5.9% of children reported experiencing at least one definite psychotic symptom ( $N = 125$ ). This is similar to the prevalence of psychotic symptoms in other community samples of children and adolescents.<sup>2,15,29,30</sup>

**Other Mental Health Problems.** At age 12, children completed the 10-item version of the Multidimensional Anxiety Scale for Children.<sup>31</sup> Those who scored at or above the 95th centile (raw score of 13 or more) constituted the “extreme” anxiety group. We used scores of 20 or more on the Children’s Depression Inventory<sup>32</sup> completed by children at age 12, to indicate clinically-significant depressive symptoms.<sup>33</sup> We derived diagnoses of conduct disorder at age 12 on the basis of mothers’ and teachers’ reports of children’s behavior problems using the Achenbach family of instruments and additional *Diagnostic and Statistical Manual of Mental Disorders*, Fourth Edition, items assessing conduct disorder which have previously been described.<sup>34</sup>

**Childhood Poly-victimization.** Exposure to several types of victimization was assessed repeatedly when the children were 5, 7, 10, and 12 years of age and dossiers have been compiled for each child with cumulative information about exposure to domestic violence between the mother and her partner, frequent bullying by peers, physical maltreatment by an adult, sexual abuse, emotional abuse and neglect, and physical neglect. Each form of victimization was rated by coders as “0” not present; “1”

probable harm, occasionally present, or evidence of only minor incidents; or “2” definite harm, frequently present, or evidence of severe incidents. Poly-victimization was defined as experiencing two or more types of victimization that were coded as “2” before age 12 ( $N = 140$ , 6.6%) compared to only one type or none ( $N = 1986$ , 93.4%). We utilized a conservative cut-off of “2” in order to increase the likelihood that we were capturing “true” incidences of victimization (rather than occasional teasing or minor forms of punishment such as being smacked on the bottom), because more severe incidences of victimization have been suggested to be more likely to be recalled accurately.<sup>35</sup> Moreover, severe victimization has been associated with the highest risk of later mental health problems.<sup>36</sup> Details about these measurements have been reported previously<sup>37,38</sup> and are provided in Supplementary Material.

**Individual-Level Protective Factors.** The Wechsler Preschool and Primary Scale of Intelligence Revised (WPPSI)<sup>39</sup> was used to assess IQ at age 5. Children were administered two subtests (Vocabulary and Block Design), and IQ scores were prorated following procedures described previously<sup>40</sup> and then standardized with a mean of 100 and standard deviation of 15.

Executive function was measured at age 5 as the mean score of three separate tasks: Mazes,<sup>41</sup> a WPPSI subtest; Day-Night,<sup>42</sup> a nonverbal analog of the Stroop task; and Sentence Working Memory, based on the Baddeley model of working memory;<sup>43,44</sup> after converting each scale to a common metric. The resulting combined score was standardized with a mean of 100 and standard deviation of 15.

After the age-5 home visits, research workers rated each twin on 25 different behavioral characteristics that assessed children’s style of approach and response to the testing session. The behavioral characteristics were derived from scales initially used to rate children enrolled in the American Collaborative Study on Cerebral Palsy, Mental Retardation, and Other Neurological Disorders of Infancy and Childhood<sup>45</sup> and were modified for use in the Dunedin Health and Development Study.<sup>46,47</sup> The current study used the measure for “Approach” as it captures contrasting traits to those associated with the broader psychosis phenotype.<sup>19</sup> This temperament measure was made up of six items including quick adjustment, friendliness, self-confidence, talkativeness, easy separation, and smiling and laughter (internal consistency:  $\alpha = 0.90$ ).

Prosocial behavior was derived using 10 items from the Revised Rutter Parent Scale for School-Age Children<sup>48</sup> to extract a prosocial score where the items were summed<sup>49</sup> for children at age 5 (internal consistency:  $\alpha = 0.77$ ). Items included “considerate of other people’s feelings,” “kind to younger children,” and “shares out treats with friends.” Questionnaires were completed by both mothers and teachers; the total scores were combined and then averaged to provide a single score.



*Family-Level Protective Factors.* Maternal warmth was assessed using procedures adapted from the Five-Minute Speech Sample method.<sup>50</sup> Mothers were asked to speak for 5 min about each of their children when they were aged 5 and again at age 10. Warmth was coded on a six-point scale from no warmth (complete absence of warmth) to high warmth (definite warmth, enthusiasm, interest in, and enjoyment of the child). Two trained raters, blind to all other E-Risk Study data, coded the tapes of the mothers' speech sample (inter-rater agreement:  $r = 0.90$ ). The maternal warmth scores at ages 5 and 10 were combined, as they were significantly correlated ( $r = 0.37$ ,  $P < .001$ ), and then averaged to provide a single score.

Mothers were asked a series of questions about the quality of their children's relationship with one another when the children were aged 7 and 10.<sup>51</sup> Mothers responded on a three-point scale to six questions (eg, "do your twins love each other," "do both your twins do nice things for each other"). The internal consistency reliability score at age 7 was 0.77 and at age 10 was 0.80. The sibling warmth scores at ages 7 and 10 were combined, because they were significantly correlated ( $r = 0.57$ ,  $P < .001$ ), and then averaged to provide a single score.

The creation of the atmosphere at home measure has been previously documented.<sup>52</sup> It was derived from the Coder's Impression Inventory, which is based on the Home Observation for Measurement of the Environment<sup>53</sup> and the University of Washington Parenting Clinic Questionnaire (Parent-Child Observations).<sup>54</sup> The Coder's Impression Inventory was rated immediately following the study visit at ages 7 and 10 by interviewers who had undergone 4-day training. This measure comprised items representing the state of the home (eg, "Are visible rooms of the house clean?"), stimulation (eg, "Is the children's art displayed in the home?"), happiness (eg, "Is this a happy home?") and chaos (eg, "Is the house chaotic or overly noisy?"). The internal consistency at age 7 was  $\alpha = 0.77$  and  $\alpha = 0.79$  at age 10. The average of the overall atmosphere at home scores at ages 7 and 10 was used for analysis because they were significantly correlated ( $r = 0.64$ ,  $P < .001$ ). The four subscales were also examined separately using an average of the scores at 7 and 10.

*Community-Level Protective Factors.* We assessed social cohesion<sup>55</sup> when children were aged 5 by asking mothers five questions, including whether their neighborhood was closeknit, whether neighbors shared values, and whether neighbors trusted and got along with each other. We derived a total score by summing the answers to all five questions (internal consistency:  $\alpha = 0.83$ ), with higher scores indicative of greater social cohesion.

*Cross-Level Protective Factors.* The presence of a supportive adult was assessed at age 12 when children were asked questions about whether they had a stable adult

figure to rely on for basic needs and support (eg, "there is an adult who I can tell almost anything to," "there is an adult who I can go to if I am in trouble"). Participants answered not true (0), sometimes true (1), or true (2). We derived a total score by summing responses to 13 items (internal consistency:  $\alpha = 0.85$ ). The questions did not ask the child to specify who the adult was, and thus, this could have been someone within or outside of their family.

*Family-Level Confounders.* Family socioeconomic status (SES) was measured via a composite of parental income (total household), education (highest for mother/father), and occupation (highest for mother/father) when children were aged 5<sup>56</sup> and was categorized into tertiles (ie, low-, medium-, and high-SES). Family psychiatric history was assessed when children were aged 12. In private interviews, mothers reported on family history of DSM disorders,<sup>57</sup> which was converted to a proportion (0–1.0) of family members with a history of psychiatric disorder.

### Statistical Analysis

Analyses were conducted in STATA 11.2 (Stata-Corp, College Station, TX). Because each study family contains two children, all statistical analyses were corrected conservatively for the nonindependence of twin observations by using tests based on the Huber/White variance estimator.<sup>58</sup> Application of this technique allows for the relaxation of the assumption of independence of observations by penalizing estimated standard errors and therefore accounting for the dependence in the data due to analyzing sets of twins. We used binary logistic regression to test the associations between (i) childhood poly-victimization and age-12 psychotic symptoms in the whole sample; and (ii) individual-, family-, and community-level protective factors and age-12 psychotic symptoms in the poly-victimized group. We also tested for interactions between significant protective factors and poly-victimization in the whole sample using logistic regression to examine whether these factors were specifically protective in relation to poly-victimization exposure. All of these analyses were adjusted for gender, family SES and family psychiatric history. Additionally, we examined whether the poly-victimized children who did not develop psychotic symptoms were more likely to have anxiety, depression, or conduct disorder at age 12, using binary logistic regression and controlling for gender and family SES.

## Results

### *Is Poly-victimization in Childhood Associated With Age-12 Psychotic Symptoms?*

Psychotic symptoms at age 12 were more commonly reported by children who were exposed to multiple types

of victimization than in those who were not poly-victimized (19.3% vs 4.9%, respectively; OR = 4.61, 95% CI 2.82–7.52,  $P < .001$ ). This association remained after controlling for family SES (OR = 4.22, 95% CI 2.50–7.10,  $P < .001$ ) and family history of mental health problems (OR = 3.72, 95% CI 2.20–6.29,  $P < .001$ ) and did not significantly differ for boys and girls (interaction: OR = 1.72, 95% CI 0.63–4.67,  $P = 0.286$ ), and therefore, all further results will be presented for both sexes together.

Among poly-victimized children ( $N = 140$ ), those who did and did not develop psychotic symptoms were comparable in terms of the total number of victimization experiences they encountered ( $\chi^2(3) = 5.807$ ,  $P = .121$ ). The two groups were also statistically comparable in terms of the types of victimization they experienced (emotional abuse and neglect: psychotic symptoms absent 41% vs present 44%,  $\chi^2(2) = 0.141$ ,  $P = .932$ ; physical abuse: 60% vs 56%,  $\chi^2(2) = 0.355$ ,  $P = .837$ ; physical neglect: 27% vs 26%,  $\chi^2(2) = 1.567$ ,  $P = .457$ ; sexual abuse: 4% vs 15%,  $\chi^2(2) = 4.058$ ,  $P = .131$ ; bullying: 45% vs 59%,  $\chi^2(2) = 2.703$ ,  $P = .259$ ; domestic violence: 78% vs 59%,  $\chi^2(2) = 4.748$ ,  $P = .093$ ).

#### *Are Individual, Family, and Community-Level Factors Associated With the Absence of Age-12 Psychotic Symptoms Among Poly-victimized Children?*

We first explored whether the potentially protective factors were operating in the context of exposure to poly-victimization. A relatively high IQ and more positive atmosphere at home were found to be associated with a reduced likelihood of psychotic symptoms emerging among children exposed to poly-victimization (indicated by OR  $< 1$ ; table 1). Higher levels of neighborhood social

cohesion showed a protective trend but fell short of statistical significance ( $P = .090$ ). The associations were almost identical and remained statistically significant when controlling for each other (IQ: OR = 0.96, 95% CI 0.93–1.00,  $P = .043$ ; atmosphere at home: OR = 0.93, 95% CI 0.87–1.00,  $P = .041$ ), indicating that their effects were independently protective against childhood psychotic symptoms in the context of poly-victimization. In terms of the atmosphere at home subscales, only the physical state of the home (OR = 0.83, 95% CI 0.70–1.00,  $P = .044$ ) was found to be independently protective against psychotic symptoms, after controlling for IQ. The subscales relating to the stimulating nature (OR = 0.89, 95% CI 0.73–1.07,  $P = .208$ ), happiness (OR = 0.78, 95% CI 0.59–1.02,  $P = .070$ ), and predictability and calmness (OR = 0.80, 95% CI 0.60–1.06,  $P = .120$ ) of the home environment were not found to be independently protective. None of the other individual-, family-, or community-level factors appeared to be significantly protective in this subsample (table 1).

#### *Are Poly-victimized Children Who Do Not Develop Psychotic Symptoms Also Protected Against Other Mental Health Problems at Age 12?*

In the group of children who did not develop age-12 psychotic symptoms ( $N = 2002$ ), poly-victimized children were more likely than those who were not poly-victimized to have conduct disorder (24.8% vs 4.1%, respectively; OR = 3.94, 95% CI 2.02–7.67,  $P < .001$ ), clinically-relevant depression (10.6% vs 2.3%; OR = 3.79, 95% CI 1.71–8.36,  $P = .001$ ), and extreme levels of anxiety (11.5% vs 5.0%; OR = 2.40, 95% CI 1.19–4.86,  $P = .015$ ) at age 12. Thus, indicating that poly-victimized children who were

**Table 1.** Associations Between Potential Protective Factors and Age-12 Psychotic Symptoms Among Children Exposed to Poly-victimization

Childhood Factors	Poly-victimized Children ( $N = 140$ )		Unadjusted (95% CI)	Adjusted OR <sup>a</sup> (95% CI)
	Psychotic Symptoms Absent $n = 113$ M (SD)	Psychotic Symptoms Present $n = 27$ M (SD)		
IQ	93.0 (13.3)	86.4 (12.2)	<b>0.96 (0.93–0.99)</b>	<b>0.96 (0.93–0.99)</b>
Executive function	96.8 (16.2)	92.6 (15.5)	0.98 (0.96–1.01)	0.98 (0.96–1.01)
Temperament (approach)	9.0 (3.4)	8.6 (3.6)	0.97 (0.86–1.10)	0.95 (0.82–1.07)
Prosocial behavior	26.1 (6.6)	23.9 (6.5)	0.95 (0.89–1.02)	0.94 (0.88–1.02)
Maternal warmth	2.9 (0.9)	2.9 (1.1)	0.97 (0.59–1.59)	0.92 (0.54–1.53)
Sibling warmth	8.9 (2.1)	9.4 (1.8)	1.15 (0.92–1.45)	1.15 (0.91–1.44)
Atmosphere at home	18.6 (7.3)	15.5 (6.3)	<b>0.94 (0.89–0.99)</b>	<b>0.93 (0.87–0.99)</b>
Supportive adult	22.7 (4.5)	21.3 (5.7)	0.94 (0.87–1.03)	0.94 (0.86–1.02)
Social cohesion	5.8 (3.3)	4.5 (3.4)	0.89 (0.77–1.01)	0.88 (0.76–1.02)

CI, confidence interval. IQ, intelligence quotient. M, mean. OR, odds ratio. SD, standard deviation.

<sup>a</sup>Adjusted for family socioeconomic status, family psychiatric history, and child's gender. All analyses account for the nonindependence of twin observations.

Bold text indicates  $P < .05$ .

protected against psychotic symptoms were not resilient more broadly to other mental health problems.

*Are These Protective Factors Specific to Poly-victimized Children?*

We further tested for interaction effects to understand whether the factors identified were particularly protective in relation to poly-victimization exposure. We did not find any of these interactions to be significant: IQ (interaction OR = 0.99, 95% CI 0.95–1.02, *P* = .520), positive atmosphere at home (interaction OR = 0.99, 95% CI 0.93–1.06, *P* = .847), or social cohesion (interaction OR = 0.98, 95% CI 0.84–1.14, *P* = .786). Indeed, having a relatively high IQ, more positive atmosphere at home, and also higher levels of neighborhood social cohesion were also associated with a reduced likelihood of psychotic symptoms in the whole sample (table 2). All three of these associations held after controlling for the other significant factors, suggesting that higher IQ (OR = 0.98, 95% CI 0.96–0.99, *P* = .001), a more positive atmosphere at home (OR = 0.95, 95% CI 0.92–0.98, *P* = .003), and increased social cohesion (OR = 0.92, 95% CI 0.86–0.98, *P* = .012) were all independently associated with a reduced likelihood of childhood psychotic symptoms in the whole sample. In terms of the atmosphere at home subscales, the physical state (OR = 0.83, 95% CI 0.75–0.91, *P* < .001), stimulating nature (OR = 0.91, 95% CI 0.83–0.99, *P* = .028), and predictability and calmness (OR = 0.75, 95% CI 0.65–0.86, *P* < .001) of the home environment were all found to be independently associated with a reduced likelihood of psychotic symptoms, after controlling for IQ and social cohesion. The subscale relating to happiness within the home (OR = 0.87, 95% CI 0.74–1.03, *P* = .114) was not found to be independently associated.

**Discussion**

To our knowledge, this is the first study to investigate individual-, family-, and community-level factors that may protect children from developing psychotic symptoms. Having a relatively high IQ and more positive

atmosphere at home were associated with a reduced likelihood of reporting psychotic symptoms at age 12, even when children had been victimized in multiple ways. We also found strong protective trends for children who lived in areas with higher levels of neighborhood social cohesion in the poly-victimized group.

First, in terms of individual-level protective factors, our findings suggest that a relatively high IQ was associated with a reduced likelihood of developing psychotic symptoms, both in the high-risk group exposed to poly-victimization and in the whole sample. This may indicate that such children do not manifest early neurodevelopmental impairments that have previously been linked to development of schizophrenia in adulthood.<sup>21</sup> In terms of potential mechanisms, it is possible that a relatively high IQ could facilitate the development of effective coping styles that have previously been found to bolster resiliency against mental health problems,<sup>59,60</sup> and therefore, might also be protective against the onset of psychotic symptoms. Higher IQ may also promote cognitive flexibility that has been associated with an absence of psychopathology.<sup>61</sup>

A more positive atmosphere at home was also found to be protective in the poly-victimized group and among the general population, which is consistent with prior research that has highlighted the protective effects of family stability in the context of adversity,<sup>62</sup> and how more chaotic living situations can increase the risk of early psychotic symptoms<sup>63</sup> and adult psychosis.<sup>64</sup> Given that some types of victimization that children are exposed to may take place outside of the home, the home environment may provide children with a safe, nurturing environment that acts as a refuge, which, in turn, may lessen the harmful effects of their experiences on cognitive and emotional processes.<sup>65</sup> Even for children where victimization does take place within the home, if there are other positive aspects to the environment, then children may be able to benefit from these, perhaps by buffering their overall stress response.<sup>66</sup> Our atmosphere at home measure captured both physical (eg, noise, cleanliness and child-focused stimulation) and emotional (ie, whether the home felt like

**Table 2.** Associations Between Potential Protective Factors in Childhood and Age-12 Psychotic Symptoms in the Full Sample

Childhood Factors	Whole Sample ( <i>N</i> = 2127)			
	No Psychotic Symptoms <i>n</i> = 2002	Psychotic Symptoms <i>n</i> = 125	Unadjusted (95% CI)	Adjusted OR <sup>a</sup> (95% CI)
	M (SD)	M (SD)		
IQ	100.5 (14.9)	93.0 (14.6)	<b>0.97 (0.95–0.98)</b>	<b>0.97 (0.96–0.98)</b>
Atmosphere at home	26.0 (5.4)	22.7 (6.6)	<b>0.92 (0.90–0.94)</b>	<b>0.93 (0.90–0.96)</b>
Social cohesion	7.7 (2.7)	6.5 (3.2)	<b>0.87 (0.82–0.93)</b>	<b>0.89 (0.84–0.96)</b>

<sup>a</sup>Adjusted for family socioeconomic status, family psychiatric history, and child’s gender. All analyses account for the nonindependence of twin observations.  
Bold text indicates *P* < .05.



a happy environment) aspects of the home environment and secondary analyses suggested that the physical attributes were more protective. It would be useful for future studies to investigate further which specific elements are protective in order to inform prevention strategies.

In terms of community factors, higher levels of neighborhood social cohesion were shown to have a protective trend in relation to childhood psychotic symptoms in the poly-victimized group and also independently among the general population. This is in keeping with previous studies that have found supportive relationships between neighbors promote positive parenting practices and may protect against the adverse effects of maltreatment.<sup>67,68</sup> Moreover, general perceptions of a supportive environment may facilitate children to more quickly obtain help with any distress they are experiencing and cope with it better,<sup>69</sup> as well as potentially accessing normalizing explanations for their anomalous experiences that may reduce the likelihood of developing clinically-relevant psychotic symptoms.<sup>70</sup>

Our finding that having a higher IQ and more positive atmosphere at home (and to a nonsignificant degree, higher social cohesion) were protective in the context of poly-victimization is important because such children are at much higher odds of developing psychotic symptoms.<sup>8,11</sup> Furthermore, this poly-victimized subgroup represent a much smaller number of individuals which is more practical in terms of targeting interventions. Assuming that our results are replicated in other cohorts, our findings could be utilized to inform which individuals should be targeted with preventive interventions, as well indicating the content or focus of such interventions, eg, engaging with families and educating parents on the importance of a structured positive home environment.

Notably, we also found that poly-victimized children in this sample who did not develop psychotic symptoms could not be considered to be broadly “resilient” to other mental health problems because they had higher rates of conduct disorder, depression, and anxiety symptoms compared to their peers who were not exposed to multiple types of victimization. Given that poly-victimization is associated with a range of mental health problems,<sup>27</sup> it is not surprising that the poly-victimized group showed elevated levels of other types of psychopathology. Our findings suggest that there may be different protective factors operating in relation to different mental health problems. A prior study<sup>22</sup> in our cohort found sibling and maternal warmth to be protective in relation to emotional and behavioral problems at age 12 among children exposed to bullying victimization, whereas the current study did not find either factor to be protective against psychotic symptoms in the context of poly-victimization. Further research is required to establish which factors protect vulnerable children against a wider range of mental health problems.

All factors found to be protective in our poly-victimized group were also found to be associated with a reduced

likelihood of age-12 psychotic symptoms in the whole sample. While it is interesting that factors continued to be protective among children at high risk, these factors were not unique or disproportionately protective in the context of poly-victimization, as demonstrated by a lack of significant interaction effects. In the absence of any other studies in this area, we would welcome replication of our findings in order to establish whether other cohorts find similar results.

### Limitations

Some limitations warrant consideration. First, despite this being a reasonably large cohort, the numbers of poly-victimized children was fairly small and this may have limited our ability to detect some associations between the proposed protective factors and a reduced likelihood of developing psychotic symptoms. These analyses thus warrant replication in even larger population-based cohorts. Second, we only focused on childhood psychotic symptoms and therefore cannot be certain whether children unaffected at this age develop psychotic symptoms later. Thirdly, while this study was able to identify specific individual-, family-, and community-level factors that were associated with a reduced likelihood of childhood psychotic symptoms, we were not able to investigate whether specific levels or ranges of these factors were associated with the lowest likelihood of psychotic symptoms emerging given the size of the poly-victimized group. However, this study does provide a useful starting point for future research to consider the relationships between different levels of each protective factor and the absence of psychotic symptoms among poly-victimized children. Fourth, childhood psychotic symptoms are associated not only with later development of schizophrenia but also other mental health problems,<sup>6,7</sup> and thus, the findings cannot specifically be generalized to clinically-relevant psychosis in adults. Fifth, we were not able to account for the specific timings of victimization exposure<sup>71</sup> nor was information available regarding attachment style,<sup>72,73</sup> and thus, we were unable to explore the potential role of these factors in our analyses. We also used a conservative cutoff to indicate the presence of victimization, which may have resulted in an underestimation of the true poly-victimization rates. Finally, the E-Risk cohort comprises twins, and whether findings from twin studies generalize to singletons is sometimes contested. However, the children in our study are representative of singletons for the prevalence of psychotic symptoms<sup>2,15,28,29</sup> and representative of UK families in terms of geographic and socioeconomic distribution.<sup>74</sup>

### Conclusion

A relatively higher IQ, a more positive atmosphere at home, and higher neighborhood social cohesion were found to be associated with an absence of psychotic

symptoms at age 12 in this general population sample, even among those exposed to multiple forms of victimization. In terms of practical implications, these findings suggest we should aim to target prevention efforts toward the smaller “higher risk” group of poly-victimized children given that resources are often severely limited. If these findings are replicated in other large population-based cohorts, then it would be useful for clinicians, educators, and community workers to develop and test interventions that could improve children’s home and community environments and support their cognitive development to hopefully increase their resiliency to childhood psychotic symptoms.

### Supplementary Material

Supplementary material is available at *Schizophrenia Bulletin* online.

### Funding

The E-Risk Study is funded by the UK Medical Research Council (G1002190). Additional support was provided by the National Institute of Child Health and Human Development (HD077482); the Jacobs Foundation; the British Academy (SQ140024 to Helen L. Fisher); a Medical Research Council Studentship to Eloise Crush; and an MQ Fellows Award to Helen L. Fisher (MQ14F40). Louise Arseneault is the Mental Health Leadership Fellow for the UK Economic and Social Research Council.

### Acknowledgments

We are grateful to the Avielle Foundation, CACI, Inc., and to the study mothers and fathers, the twins, and the twins’ teachers for their participation. Our thanks to members of the Environmental Risk team for their dedication, hard work, and insights, and particularly to Professors Terrie Moffitt and Avshalom Caspi for their leadership of the childhood phases of the study. The authors have declared that there are no conflicts of interest in relation to the subject of this study.

### References

1. Linscott RJ, van Os J. An updated and conservative systematic review and meta-analysis of epidemiological evidence on psychotic experiences in children and adults: on the pathway from proneness to persistence to dimensional expression across mental disorders. *Psychol Med*. 2013;43:1133–1149.
2. Kelleher I, Connor D, Clarke MC, Devlin N, Harley M, Cannon M. Prevalence of psychotic symptoms in childhood and adolescence: a systematic review and meta-analysis of population-based studies. *Psychol Med*. 2012;42:1857–1863.
3. Polanczyk G, Moffitt TE, Arseneault L, et al. Etiological and clinical features of childhood psychotic symptoms: results from a birth cohort. *Arch Gen Psychiatry*. 2010;67:328–338.
4. Kelleher I, Wigman JT, Harley M, et al. Psychotic experiences in the population: association with functioning and mental distress. *Schizophr Res*. 2015;165:9–14.
5. Kelleher I, Lynch F, Harley M, et al. Psychotic symptoms in adolescence index risk for suicidal behavior: findings from 2 population-based case-control clinical interview studies. *Arch Gen Psychiatry*. 2012;69:1277–1283.
6. Fisher HL, Caspi A, Poulton R, et al. Specificity of childhood psychotic symptoms for predicting schizophrenia by 38 years of age: a birth cohort study. *Psychol Med*. 2013;43:2077–2086.
7. Poulton R, Caspi A, Moffitt TE, Cannon M, Murray R, Harrington H. Children’s self-reported psychotic symptoms and adult schizophreniform disorder: a 15-year longitudinal study. *Arch Gen Psychiatry*. 2000;57:1053–1058.
8. Arseneault L, Cannon M, Fisher HL, Polanczyk G, Moffitt TE, Caspi A. Childhood trauma and children’s emerging psychotic symptoms: a genetically sensitive longitudinal cohort study. *Am J Psychiatry*. 2011;168:65–72.
9. Schreier A, Wolke D, Thomas K, et al. Prospective study of peer victimization in childhood and psychotic symptoms in a nonclinical population at age 12 years. *Arch Gen Psychiatry*. 2009;66:527–536.
10. Fisher HL, Schreier A, Zammit S, et al. Pathways between childhood victimization and psychosis-like symptoms in the ALSPAC birth cohort. *Schizophr Bull*. 2013;39:1045–1055.
11. Kelleher I, Keeley H, Corcoran P, et al. Childhood trauma and psychosis in a prospective cohort study: cause, effect, and directionality. *Am J Psychiatry*. 2013;170:734–741.
12. Morgan C, Gayer-Anderson C. Childhood adversities and psychosis: evidence, challenges, implications. *World Psychiatry*. 2016;15:93–102.
13. Johns LC, Cannon M, Singleton N, et al. Prevalence and correlates of self-reported psychotic symptoms in the British population. *Br J Psychiatry*. 2004;185:298–305.
14. Kremen WS, Buka SL, Seidman LJ, Goldstein JM, Koren D, Tsuang MT. IQ decline during childhood and adult psychotic symptoms in a community sample: a 19-year longitudinal study. *Am J Psychiatry*. 1998;155:672–677.
15. Horwood J, Salvi G, Thomas K, et al. IQ and non-clinical psychotic symptoms in 12-year-olds: results from the ALSPAC birth cohort. *Br J Psychiatry*. 2008;193:185–191.
16. Fresán A, León-Ortiz P, Robles-García R, et al. Personality features in ultra-high risk for psychosis: a comparative study with schizophrenia and control subjects using the Temperament and Character Inventory-Revised (TCI-R). *J Psychiatr Res*. 2015;61:168–173.
17. Smith MJ, Cloninger CR, Harms MP, Csernansky JG. Temperament and character as schizophrenia-related endophenotypes in non-psychotic siblings. *Schizophr Res*. 2008;104:198–205.
18. Nitzburg GC, Malhotra AK, DeRosse P. The relationship between temperament and character and subclinical psychotic-like experiences in healthy adults. *Eur Psychiatry*. 2014;29:352–357.
19. Nitzburg GC, Gopin CB, Peters BD, Karlsgodt KH, Malhotra AK, DeRosse P. The relationship between temperament and character and psychotic-like experiences in healthy children and adolescents. *Eur Psychiatry*. 2016;31:60–65.

20. Jones P, Rodgers B, Murray R, Marmot M. Child development risk factors for adult schizophrenia in the British 1946 birth cohort. *Lancet*. 1994;344:1398–1402.
21. Cannon M, Caspi A, Moffitt TE, et al. Evidence for early-childhood, pan-developmental impairment specific to schizophreniform disorder: results from a longitudinal birth cohort. *Arch Gen Psychiatry*. 2002;59:449–456.
22. Bowes L, Maughan B, Caspi A, Moffitt TE, Arseneault L. Families promote emotional and behavioural resilience to bullying: evidence of an environmental effect. *J Child Psychol Psychiatry*. 2010;51:809–817.
23. Newbury J, Arseneault L, Caspi A, Moffitt TE, Odgers CL, Fisher HL. Why Are Children in Urban Neighborhoods at Increased Risk for Psychotic Symptoms? Findings From a UK Longitudinal Cohort Study. *Schizophr Bull*. 2016;42:1372–1383.
24. Newbury J, Arseneault L, Caspi A, Moffitt TE, Odgers CL, Fisher HL. Cumulative effects of neighborhood social adversity and personal crime victimization on adolescent psychotic experiences. *Schizophr Bull*. 2018;44:348–358.
25. Gayer-Anderson C, Morgan C. Social networks, support and early psychosis: a systematic review. *Epidemiol Psychiatr Sci*. 2013;22:131–146.
26. Gayer-Anderson C, Fisher HL, Fearon P, et al. Gender differences in the association between childhood physical and sexual abuse, social support and psychosis. *Soc Psychiatry Psychiatr Epidemiol*. 2015;50:1489–1500.
27. Turner HA, Shattuck A, Finkelhor D, Hamby S. Effects of poly-victimization on adolescent social support, self-concept, and psychological distress. *J Interpers Violence*. 2017;32:755–780.
28. Moffitt TE, E-Risk Study Team. Teen-aged mothers in contemporary Britain. *J Child Psychol Psychiatry*. 2002;43:1–16.
29. Yoshizumi T, Murase S, Honjo S, Kaneko H, Murakami T. Hallucinatory experiences in a community sample of Japanese children. *J Am Acad Child Adolesc Psychiatry*. 2004;43:1030–1036.
30. Scott J, Chant D, Andrews G, McGrath J. Psychotic-like experiences in the general community: the correlates of CIDI psychosis screen items in an Australian sample. *Psychol Med*. 2006;36:231–238.
31. March JS, Parker JD, Sullivan K, Stallings P, Conners CK. The Multidimensional Anxiety Scale for Children (MASC): factor structure, reliability, and validity. *J Am Acad Child Adolesc Psychiatry*. 1997;36:554–565.
32. Kovacs M. *Children's Depression Inventory (CDI) Manual*. North Tonawanda, NY: Multi-Health Systems; 1992.
33. Rivera CL, Bernal G, Rosselló J. The Children Depression Inventory (CDI) and the Beck Depression Inventory (BDI): their validity as screening measures for major depression in a group of Puerto Rican adolescents. *Int J Clin Heal Psychol*. 2005;5:485–498.
34. Kim-Cohen J, Moffitt TE, Caspi A, Taylor A. Genetic and environmental processes in young children's resilience and vulnerability to socioeconomic deprivation. *Child Dev*. 2004;75:651–668.
35. Hardt J, Rutter M. Validity of adult retrospective reports of adverse childhood experiences: review of the evidence. *J Child Psychol Psychiatry*. 2004;45:260–273.
36. Mullen PE, Martin JL, Anderson JC, Romans SE, Herbison GP. Childhood sexual abuse and mental health in adult life. *Br J Psychiatry*. 1993;163:721–732.
37. Fisher HL, Caspi A, Moffitt TE, et al. Measuring adolescents' exposure to victimization: the Environmental Risk (E-Risk) Longitudinal Twin Study. *Dev Psychopathol*. 2015;27:1399–1416.
38. Danese A, Moffitt TE, Arseneault L, et al. The origins of cognitive deficits in victimized children: implications for neuroscientists and clinicians. *Am J Psychiatry*. 2017;174:349–361.
39. Wechsler D. *Wechsler Preschool and Primary Scale of Intelligence-Revised*. London, England: The Psychological Corporation; 1990.
40. Sattler J. *Assessment of Children: WISC-III and WPPSI-R Supplement*. San Diego, CA: Jerome M. Sattler, Publisher, Inc.; 1992.
41. Grodzinsky GM, Diamond R. Frontal lobe functioning in boys with attention-deficit hyperactivity disorder. *Dev Neuropsychol*. 1992;8:427–445.
42. Gerstadt CL, Hong YJ, Diamond A. The relationship between cognition and action: performance of children 3 1/2-7 years old on a Stroop-like day-night test. *Cognition*. 1994;53:129–153.
43. Baddeley A. Exploring the central executive. *Q J Exp Psychol*. 1996;49A:5–28.
44. Baddeley AD. *Working Memory*. England: Oxford University Press; 1986.
45. Goldsmith HH, Gottesman II. Origins of variation in behavioral style: a longitudinal study of temperament in young twins. *Child Dev*. 1981;52:91–103.
46. Caspi A, Henry B, McGee RO, Moffitt TE, Silva PA. Temperamental origins of child and adolescent behavior problems: from age three to age fifteen. *Child Dev*. 1995;66:55–68.
47. Henry B. Reliability and validity of an observational measure of early-emerging individual differences among preschool children. Unpubl. Manuscript. Colby Coll. Waterville, Maine; 1999.
48. Sclare I. *The Child Psychology Portfolio*. Windsor, Berkshire, United Kingdom: NFER-Nelson Publishing Company; 1997.
49. Goodman R. A modified version of the Rutter parent questionnaire including extra items on children's strengths: a research note. *J Child Psychol Psychiatry*. 1994;35:1483–1494.
50. Magaña AB, Goldstein JM, Karno M, Miklowitz DJ, Jenkins J, Falloon IR. A brief method for assessing expressed emotion in relatives of psychiatric patients. *Psychiatry Res*. 1986;17:203–212.
51. Jaffee SR, Caspi A, Moffitt TE, Polo-Tomás M, Taylor A. Individual, family, and neighborhood factors distinguish resilient from non-resilient maltreated children: a cumulative stressors model. *Child Abuse Negl*. 2007;31:231–253.
52. Kim-Cohen J, Caspi A, Taylor A, et al. MAOA, maltreatment, and gene-environment interaction predicting children's mental health: new evidence and a meta-analysis. *Mol Psychiatry*. 2006;11:903–913.
53. Bradley RH, Caldwell BM. Home observation for measurement of the environment: a validation study of screening efficiency. *Am J Ment Defic*. 1977;81:417–420.
54. Webster-Stratton C. Preventing conduct problems in Head Start children: strengthening parenting competencies. *J Consult Clin Psychol*. 1998;66:715–730.
55. Sampson RJ, Raudenbush SW, Earls F. Neighborhoods and violent crime: a multilevel study of collective efficacy. *Science*. 1997;277:918–924.



56. Trzesniewski KH, Moffitt TE, Caspi A, Taylor A, Maughan B. Revisiting the association between reading achievement and antisocial behavior: new evidence of an environmental explanation from a twin study. *Child Dev.* 2006;77:72–88.
57. Milne BJ, Caspi A, Crump R, et al. The validity of the family history screen for assessing family history of mental disorders. *Am J Med Genet B Neuropsychiatr Genet.* 2009;150B: 41–49.
58. Williams RL. A note on robust variance estimation for cluster-correlated data. *Biometrics.* 2000;56:645–646.
59. Bonanno GA. Loss, trauma, and human resilience: have we underestimated the human capacity to thrive after extremely aversive events? *Am Psychol.* 2004;59:20–28.
60. Dumont M, Provost MA. Resilience in adolescents: protective role of social support, coping strategies, self-esteem, and social activities on experience of stress and depression. *J Youth Adolesc.* 1999;28:343–363.
61. Kashdan TB, Rottenberg J. Psychological flexibility as a fundamental aspect of health. *Clin Psychol Rev.* 2010;30:865–878.
62. Harden BJ. Safety and stability for foster children: a developmental perspective. *Future Child.* 2004;14:30–47.
63. Winsper C, Wolke D, Bryson A, Thompson A, Singh SP. School mobility during childhood predicts psychotic symptoms in late adolescence. *J Child Psychol Psychiatry.* 2016;57:957–966.
64. Fisher HL, Jones PB, Fearon P, et al. The varying impact of type, timing and frequency of exposure to childhood adversity on its association with adult psychotic disorder. *Psychol Med.* 2010;40:1967–1978.
65. Garety PA, Kuipers E, Fowler D, Freeman D, Bebbington PE. A cognitive model of the positive symptoms of psychosis. *Psychol Med.* 2001;31:189–195.
66. Repetti RL, Taylor SE, Seeman TE. Risky families: family social environments and the mental and physical health of offspring. *Psychol Bull.* 2002;128:330–366.
67. Maguire-Jack K, Showalter K. The protective effect of neighborhood social cohesion in child abuse and neglect. *Child Abuse Negl.* 2016;52:29–37.
68. Yonas MA, Lewis T, Hussey JM, et al. Perceptions of neighborhood collective efficacy moderate the impact of maltreatment on aggression. *Child Maltreat.* 2010;15:37–47.
69. Cohen S, Wills TA. Stress, social support, and the buffering hypothesis. *Psychol Bull.* 1985;98:310–357.
70. Hodges A, Byrne M, Grant E, Johnstone E. People at risk of schizophrenia. Sample characteristics of the first 100 cases in the Edinburgh High-Risk Study. *Br J Psychiatry.* 1999;174:547–553.
71. Manly JT, Kim JE, Rogosch FA, Cicchetti D. Dimensions of child maltreatment and children's adjustment: contributions of developmental timing and subtype. *Dev Psychopathol.* 2001;13:759–782.
72. Cicchetti D, Rogosch FA, Toth SL. Fostering secure attachment in infants in maltreating families through preventive interventions. *Dev Psychopathol.* 2006;18:623–649.
73. Lieberman, A. F. Traumatic stress and quality of attachment: reality and internalization in disorders of infant mental health. *Infant Ment Health J.* 2004; 25:336–351.
74. Caspi A, Taylor A, Moffitt TE, Plomin R. Neighborhood deprivation affects children's mental health: environmental risks identified in a genetic design. *Psychol Sci.* 2000;11:338–342.

## **4.1 Chapter 4: Supplementary Materials**

### **Study Cohort**

Participants were members of the Environmental Risk (E-Risk) Longitudinal Twin Study, which tracks the development of a nationally-representative birth cohort of 2232 British twin children. The sample was drawn from a larger cohort of twins born in England and Wales in 1994-1995.<sup>1</sup> Full details about the sample are reported elsewhere.<sup>2</sup> Briefly, the E-Risk sample was constructed in 1999-2000, when 1116 families with same-sex 5-year-old twins (93% of those eligible) participated in home-visit assessments. Families were recruited to represent the UK population of families with newborns in the 1990s, based on residential location throughout England and Wales and mothers' age. Teenaged mothers with twins were over-selected to replace high-risk families who were selectively lost to the register through non-response. Older mothers having twins via assisted reproduction were under-selected to avoid an excess of well-educated older mothers. E-Risk families are representative of UK households across the spectrum of neighborhood-level deprivation: 25.6% of E-Risk families live in "wealthy achiever" neighborhoods compared to 25.3% of households nation-wide; 5.3% vs 11.6% live in "urban prosperity" neighborhoods; 29.6% vs 26.9% live in "comfortably off" neighborhoods; 13.4% vs 13.9% live in "moderate means" neighborhoods; and 26.1% vs 20.7% live in "hard-pressed" neighborhoods.<sup>3,4</sup> E-Risk families under-represent "urban prosperity" neighborhoods because such households are likely to be childless. The sample comprised 56% monozygotic and 44% dizygotic twin pairs, and sex was evenly distributed within zygosity (49% male). All families were English speaking, and the majority (93.7%) were White. Follow-up home visits were conducted when children were 7 years (98% of the 1116 E-Risk Study families participated), 10 years (96% participation) and 12 years (96% participation). Home visits at ages 5, 7, 10, and 12 years included assessments with participants as well as their mother (or primary caretaker). Each twin participant was assessed by a different interviewer. The Joint South London and Maudsley and the Institute of Psychiatry Research Ethics Committee approved each phase of the study. Parents gave informed consent and children gave assent.

### **Measure of psychotic symptoms**

E-Risk families were visited by mental health trainees or professionals when children were aged 12.<sup>5</sup> Each child was privately interviewed about 7 psychotic symptoms pertaining to delusions and hallucinations, with items including "have other people ever read your



thoughts?,” “have you ever thought you were being followed or spied on?,” and “have you ever heard voices that other people cannot hear?.” This interview has been described in detail previously.<sup>5</sup> The item choice was guided by the Dunedin Study’s age-11 interview protocol<sup>6</sup> and an instrument prepared for the Avon Longitudinal Study of Parents and Children.<sup>7</sup> Interviewers coded each experience 0, 1, 2 indicating respectively “not a symptom,” “probable symptom,” and “definite symptom.” A conservative approach was taken in designating a child’s report as a symptom. First, the interviewer probed using standard prompts designed to discriminate between experiences that were plausible (e.g., “I was followed by a man after school”) and potential symptoms (e.g., “I was followed by an angel who guards my spirit”), and wrote down the child’s narrative description of the experience. Second, items and interviewer notes were assessed by a psychiatrist expert in schizophrenia, a psychologist expert in interviewing children, and a child and adolescent psychiatrist to verify the validity of the symptoms. Third, because children were twins, experiences limited to the twin relationship (e.g., “My twin and I often know what each other are thinking”) were coded as “not a symptom”. Children were only designated as experiencing psychotic symptoms if they reported at least one definite symptom. At age 12, 5.9% ( $N = 125$ ) of children reported experiencing psychotic symptoms. This is similar to the prevalence of psychotic symptoms in other community samples of children and adolescents.<sup>8-12</sup> Furthermore, we have previously shown that childhood psychotic symptoms in this cohort have good construct validity, sharing many of the genetic, social, neurodevelopmental, and behavioral risk factors and correlates as adult schizophrenia.<sup>5</sup>

### **Measures of victimization**

Exposure to several types of victimization was assessed repeatedly when the children were 5, 7, 10, and 12 years of age and dossiers have been compiled for each child with cumulative information about exposure to domestic violence between the mother and her partner; frequent bullying by peers; physical maltreatment by an adult; sexual abuse; emotional abuse; and neglect. The E-Risk team has previously reported evidence on the reliability and validity of the measures of domestic violence,<sup>13</sup> bullying,<sup>14,15</sup> physical maltreatment and sexual abuse,<sup>16</sup> emotional abuse,<sup>17</sup> and physical neglect.<sup>18</sup> All the component measures are outlined briefly below.

*Physical Domestic Violence.* Mothers reported about perpetration of and victimization by 12 forms of physical violence (e.g., slapping, hitting, kicking, strangling) from the Conflict Tactics

Scale,<sup>19</sup> on three assessment occasions during the child's first decade of life (when the children were 5, 7, and 10 years of age). Reports of either perpetration or victimization constituted evidence of physical domestic violence. Families in which no physical violence took place were coded as 0 (55.2%); families in which physical violence took place on one occasion were coded as 1 (28.0%); and families in which physical violence took place on multiple occasions were coded as 2 (16.8%).

*Bullying by Peers.* Experiences of victimization by bullies were assessed using both mothers' and children's reports. During the interview, the following standard definition of bullying was read out: *"Someone is being bullied when another child (a) says mean and hurtful things, makes fun, or calls a person mean and hurtful names; (b) completely ignores or excludes someone from their group of friends or leaves them out on purpose; (c) hits, kicks, or shoves a person, or locks them in a room; (d) tells lies or spreads rumours about them; and (e) other hurtful things like these. We call it bullying when these things happen often, and when it is difficult to make it stop. We do not call it bullying when it is done in a friendly or playful way."* Mothers were interviewed when children were 7, 10, and 12 years old and asked whether either twin had been bullied by another child, responding never, yes, or frequently. We combined mothers' reports when children were age 7 and 10 to derive a measure of victimization during primary school. Mothers' reports when the children were 12 years old indexed victimization during secondary school. During private interviews with the children when they were 12 years old, the children indicated whether they had been bullied by another child during primary or secondary school. When a mother or a child reported victimization, the interviewer asked them to describe what happened. Notes taken by the interviewers were later checked by an independent rater to verify that the events reported could be classified as instances of bullying operationally defined as evidence of (a) repeated harmful actions, (b) between children, and (c) where there is a power differential between the bully and the victim.<sup>15</sup> Although inter-rater reliability between mothers and children was only modest ( $kappa = 0.20-0.29$ ), reports of victimization from both informants were similarly associated with children's emotional and behavioural problems, suggesting that each informant provides a unique but meaningful perspective on bullying involvement.<sup>15</sup> We thus combined mother and child reports of victimization to capture all instances of bullying victimization for primary and secondary school separately: reported as not victimized by both mother and child; reported by either mother or child as being occasionally victimized; and reported as being occasionally victimized by both informants or as frequently victimized

by either mother or child or both.<sup>20</sup> We then combined these primary and secondary school ratings to create a bullying victimization variable for the entire childhood period (5-12 years). Children who were never bullied in primary or secondary school or occasionally bullied during one of these time periods were coded as 0 (55.5%); children who were occasionally bullied during primary and secondary school, or frequently bullied during one of these time periods were coded as 1 (35.6%); and children who were frequently bullied at both primary and secondary school were coded as 2 (8.9%).

*Physical and sexual harm by an adult.* We assessed childhood physical and sexual harm in the E-Risk Study using an approach that resembles the process undertaken by child protection agencies. Essentially this is a two-stage process. In child protection, professionals such as teachers working with children typically raise concerns if they observe signs or symptoms or if they become aware of risk that children are victims of violence. When concerns are raised, child protection officers then review the concerns and evaluate them in the context of information previously gathered on that child or family in order to determine the likelihood that abuse has taken place. In the E-Risk Study, research workers visited the home in pairs, and were extensively trained to detect signs of abuse or neglect. Each time the two research workers visited a home, they interviewed the mother using a structured interview about child harm, tested the children, and observed the family environment using the Home Observation for Measurement of the Environment (HOME).<sup>21</sup> If either research worker had any concerns, they flagged up the case for review. Immediately after each home visit, a review was performed if a family was flagged. In addition, at each wave, any family who had been flagged on a prior wave of the study was automatically reviewed again. The reviews were performed independently by at least 2 clinical psychologists or psychiatrists, and were based on comprehensive dossiers compiled across multiple home visits for each study member during the course of the ongoing longitudinal study.

At age 5, assessments were based on the standardised clinical protocol from the MultiSite Child Development Project.<sup>22,23</sup> At ages 7, 10, and 12 this interview was modified to expand its coverage of contexts for child harm. Interviews were designed to enhance mothers' comfort with reporting valid child maltreatment information, while also meeting researchers' responsibilities for referral under the UK Children Act. Specifically, mothers were asked whether either of their twins had been intentionally harmed (physically or sexually) by an adult or had contact with welfare agencies. If caregivers endorsed a question, research workers made extensive notes on what had happened, and indicated whether

physical and/or psychological harm had occurred. Under the U.K. Children Act, our responsibility was to secure intervention if maltreatment was current and ongoing. Such intervention on behalf of E-Risk families was carried out with parental cooperation in all but one case. No families left the study following intervention.

Over the years of data collection, the study developed a cumulative profile for each child, comprising the caregiver reports, recorded debriefings with research workers who had coded any indication of maltreatment at any of the successive home visits, recorded narratives of the successive caregiver interviews, and information from clinicians whenever the Study team made a child-protection referral. Each time we visited a home, the research workers flagged concerns, and if there was sufficient evidence to code definite harm then, we did so. If evidence only met the level of probable harm, we kept an “ongoing concern list” and if, at a later wave, there was continued evidence of probable harm, or new evidence, the code was upgraded to definite harm. The profiles were reviewed at the end of the age-12 phase by at least two clinical psychologists or psychiatrists. Initial inter-rater agreement between the coders was 90% in cases for whom maltreatment was identified (100% for cases of sexual abuse), and discrepantly coded cases were resolved by consensus review. These were coded as: 0 = no physical harm at any age; 1 = probable physical harm at any age; and 2 = definite physical harm at any age. There were 15.0% of children coded as probably being exposed to physical harm and 5.1% as definitely physically harmed by 12 years of age. There were 1.5% of the children coded as being exposed to sexual abuse.

*Emotional abuse and neglect.* These forms of maltreatment were coded from research workers’ narratives of the home visits at ages 5, 7, 10, and 12. We coded quite severe examples of parental behavior observed. For example, a mother who had schizophrenia screamed and swore at the children throughout the home visit. As another example, a father who was drunk during the home visit repeatedly spoke abusively to the children in front of the research workers. We found that coders could not empirically separate emotional abuse and emotional neglect in a reliable way and thus such experiences were coded together as emotional abuse/neglect. Inter-rater agreement between the coders exceeded 85% for cases with emotional abuse and neglect, and discrepant cases were resolved by consensus review. Children with no evidence of emotional abuse/neglect were coded as 0 (88.3%), those where there was some indication of emotionally inappropriate/potentially abusive or neglectful behavior were coded as 1 (8.7%), and where there was evidence of severe emotional abuse/neglect the children were coded as 2 (3.0%).

*Physical neglect.* The cumulative observations of the physical state of the home environment documented by the research workers during home visits to the twins at ages 5, 7, 10 and 12 were reviewed by two raters for evidence of physical neglect. This was defined as any sign that the caretaker was not providing a safe, sanitary, or healthy environment for the child. This included the child not having proper clothing or food, as well as grossly unsanitary home environments. (However, this did not include a family living in a crime-ridden neighborhood for economic reasons.) Inter-rater agreement between the coders exceeded 85%, and discrepantly coded cases were resolved by consensus review. Children with no evidence of physical neglect were coded as 0 (90.9%), those for whom there was an indication of minor physical neglect were coded as 1 (7.1%), and where there was evidence of severe physical neglect the children were coded as 2 (2.0%).

*Childhood poly-victimization.* Finkelhor et al<sup>24</sup> operationalize poly-victimisation as the total number of victimization types that a child experiences. The E-Risk poly-victimization variable was derived by summing all victimization experiences that received a code of '2': 73.5% of children had zero victimization experiences; 20.1% had 1 victimization experience; 3.8% had 2 victimization experiences; 1.8% had 3 victimization experiences; 0.8% had 4 victimization experiences; and 0.1% had 5 victimization experiences. For the current analysis, we dichotomized the poly-victimization variable into those children having zero or one victimization experience (N = 1987, 93.4%), and those who had 2 or more victimization experiences (N = 140, 6.6%), who had completed the psychotic symptoms interview at age 12.

## References

1. Trouton A, Spinath FM, Plomin R. Twins Early Development Study (TEDS): a multivariate, longitudinal genetic investigation of language, cognition and behavior problems in childhood. *Twin Res.* 2002;5(5):444-448.
2. Moffitt TE, E-Risk Study Team. Teen-aged mothers in contemporary Britain. *J Child Psychol Psychiatry.* 2002;43(5):1-16.
3. CACI. *ACORN user guide*. London, UK: CACI Information Services; 2006.
4. Caspi A, Taylor A, Moffitt TE, Plomin R. Neighborhood deprivation affects children's mental health: environmental risks identified in a genetic design. *Psychol Sci.* 2000;11(4):338-342.
5. Polanczyk G, Moffitt T, Arseneault L, et al. Etiological and clinical features of childhood psychotic symptoms. *Arch Gen Psychiatry.* 2010;67(4):328-338.
6. Poulton R, Caspi A, Moffitt TE, et al. Children's self-reported psychotic symptoms and adult schizophreniform disorder: a 15-year longitudinal study. *Arch Gen Psychiatry.* 2000;57:1053-1058.
7. Schreier A, Wolke D, Thomas K, et al. Prospective study of peer victimization in childhood and psychotic symptoms in a non-clinical population at age 12 years. *Arch Gen Psychiatry.* 2009;66:527-536.
8. Kelleher I, Connor D, Clarke MC, Devlin N, Harley M, Cannon M. Prevalence of psychotic symptoms in childhood and adolescence: a systematic review and meta-analysis of population-based studies. *Psychol Med.* 2012;42:1857-1863.
9. Horwood J, Salvi G, Thomas K, et al. IQ and non-clinical psychotic symptoms in 12-year-olds: results from the ALSPAC birth cohort. *Br J Psychiatry.* 2008;193(3):185-191.
10. Yoshizumi T, Murase S, Honjo S, Kaneko H, Murakami T. Hallucinatory experiences in a community sample of Japanese children. *J Am Acad Child Adolesc Psychiatry.* 2004;43(8):1030-1036.
11. Scott J, Chant D, Andrews G, McGrath J. Psychotic-like experiences in the general community: the correlates of CIDI psychosis screen items in an Australian sample. *Psychol Med.* 2006;36(2):231-238.
12. Dhossche D, Ferdinand R, Van der Ende J, Hofstra MB, Verhulst F. Diagnostic outcome of self-reported hallucinations in a community sample of adolescents. *Psychol Med.* 2002;32:619-627.
13. Moffitt TE, Caspi A, Krueger RF, et al. Do partners agree about abuse in their relationship? A psychometric evaluation of inter-partner agreement. *Psychol Assess.* 1997;9:47-56.

14. Arseneault L, Walsh E, Trzesniewski K, et al. Bullying victimization uniquely contributes to adjustment problems in young children: a nationally representative cohort study. *Pediatr*. 2006;118:130-138.
15. Shakoor S, Jaffee SR, Andreou P, et al. Mothers and children as informants of bullying victimization: results from an epidemiological cohort of children. *J Abnorm Child Psychol*. 2011;39:379-387.
16. Jaffee SR, Caspi A, Moffitt TE, et al. Physical maltreatment victim to antisocial child: evidence of an environmentally mediated process. *J Abnorm Psychol*. 2004;113:44-55.
17. Danese A, Moffitt TE, Arseneault L, et al. The origins of cognitive deficits in victimized children: implications for neuroscientists and clinicians. *Am J Psychiatry*. 2016;doi:10.1176/appi.ajp.2016.16030333.
18. Fisher HL, Caspi A, Moffitt TE, et al. Measuring adolescents' exposure to victimization: The Environmental Risk (E-Risk) Longitudinal Twin Study. *Dev Psychopathol*. 2015;27:1399-1416.
19. Straus M. Measuring intrafamily conflict and violence: the Conflict Tactics (CT) scales. In: M. A. Straus & R. G. Gelles (Eds.), *Physical violence in American families: risk factors and adaptations to violence in 8,145 families* (pp.403-424). New Brunswick, NJ: Transaction Press; 1990.
20. Bowes L, Maughan B, Ball H, et al. Chronic bullying victimization across school transitions: the role of genetic and environmental influences. *Dev Psychopathol*. 2013;25(2):333-346.
21. Bradley R, Caldwell B. Home observation for measurement of the environment: a validation study of screening efficiency. *Am J Ment Defic*. 1977;81:417-420.
22. Dodge KA, Bates JE, Pettit GS. Mechanisms in the cycle of violence. *Science*. 1990;250:1678-1683.
23. Lansford JE, Dodge KA, Pettit GS, Batesm JE, Crozier J, Kaplow J. Long-term effects of early child physical maltreatment on psychological, behavioral, and academic problems in adolescence: a 12-year prospective study. *Arch Pediatr Adolesc Med*. 2002;156:824-830.
24. Finkelhor D, Ormrod RK, Turner HA. Poly-victimization: a neglected component in child victimization. *Child Abuse Negl*. 2007;31:7-26.

## **Chapter 5 (Part 1): Protective factors for psychotic experiences amongst adolescents exposed to multiple forms of victimisation**

This study was accepted for publication and therefore this chapter contains an exact copy of the published version.

### **Reference:**

Crush E., Arseneault, L., Moffitt, T.E., Danese, A., Caspi, A., Jaffee, S.R., . . . , Fisher, H.L. (2018). Protective factors for psychotic experiences amongst adolescents exposed to multiple forms of victimization. *Journal of Psychiatric Research*, 104, 32-28.





# Protective factors for psychotic experiences amongst adolescents exposed to multiple forms of victimization



Eloise Crush<sup>a</sup>, Louise Arseneault<sup>a</sup>, Terrie E. Moffitt<sup>a,b,c</sup>, Andrea Danese<sup>a,d,e</sup>, Avshalom Caspi<sup>a,b,c</sup>, Sara R. Jaffee<sup>f</sup>, Timothy Matthews<sup>a</sup>, Helen L. Fisher<sup>a,\*</sup>

<sup>a</sup> King's College London, Social, Genetic & Developmental Psychiatry Centre, Institute of Psychiatry, Psychology & Neuroscience, London, UK

<sup>b</sup> Department of Psychology and Neuroscience, Duke University, Durham, NC, USA

<sup>c</sup> Department of Psychiatry and Behavioral Sciences, Duke University, Durham, NC, USA

<sup>d</sup> King's College London, Department of Child & Adolescent Psychiatry, Institute of Psychiatry, Psychology & Neuroscience, London, UK

<sup>e</sup> National & Specialist CAMHS Trauma and Anxiety Clinic, South London and Maudsley NHS Foundation Trust, London, UK

<sup>f</sup> Department of Psychology, University of Pennsylvania, Philadelphia, PA, USA

## ARTICLE INFO

### Keywords:

Adolescence

Exercise

Poly-victimization

Psychosis

Resilience

Social support

## ABSTRACT

Experiencing multiple types of victimization (poly-victimization) during adolescence is associated with the onset of psychotic experiences (such as hearing voices, having visions, or being extremely paranoid). However, many poly-victimized adolescents will not develop such subclinical phenomena and the factors that protect them are unknown. This study investigated whether individual, family, or community-level characteristics were associated with an absence of psychotic experiences amongst poly-victimized adolescents. Participants were from the Environmental Risk (E-Risk) Longitudinal Twin Study, a nationally-representative cohort of 2232 UK-born twins. Exposure to seven different types of victimization between ages 12–18 was ascertained using a modified version of the Juvenile Victimization Questionnaire at age 18. Adolescents were also interviewed about psychotic experiences at age 18. Protective factors were measured at ages 12 and 18. We found that exposure to poly-victimization during adolescence was associated with age-18 psychotic experiences (OR = 4.62, 95% CI 3.59–5.94,  $P < 0.001$ ), but more than a third of the poly-victimized adolescents reported having no psychotic experiences (40.1%). Greater social support was found to be protective against adolescent psychotic experiences even amongst those exposed to poly-victimization. Engaging in physical activity and greater neighborhood social cohesion were also associated with a reduced likelihood of age-18 psychotic experiences in the whole sample, with non-significant trends in the poly-victimized group. Increasing social support and promoting physical activity appear to be important areas for future research into the development of preventive interventions targeting adolescent psychotic experiences. This adds further weight to calls to increase the promotion of these factors on a public health scale.

## 1. Background

Psychotic experiences (such as hearing voices, having visions, and feeling extremely paranoid) occurring during late adolescence have been found to precede the development of psychotic disorders (Dominguez et al., 2011) and a wide range of other severe mental health problems including suicide attempts (McGrath et al., 2016). Psychotic experiences during this developmental stage have also been shown to be associated with greater psychiatric comorbidity than psychotic phenomena occurring during late childhood (Kelleher et al., 2012a). We must, therefore, develop a better understanding of how to prevent the development of psychotic experiences in adolescence.

Exposure to victimization (e.g., physical abuse, sexual abuse, bullying by peers) during adolescence has been found to be a major risk factor for the onset of psychotic experiences in this period (Kelleher et al., 2013). Moreover, experiencing two or more different types of victimization (often referred to as poly-victimization; Finkelhor et al., 2007) has been associated with the highest risk of psychotic phenomena emerging (Arseneault et al., 2011). Identifying multi-level factors that are protective against the development of psychotic experiences, particularly in this high-risk group of poly-victimized adolescents, may be especially relevant for prevention efforts.

There has been little research to date on protective factors for psychotic phenomena, with the vast majority of studies focusing on

\* Corresponding author. SGDP Centre, Institute of Psychiatry, Psychology & Neuroscience, King's College London, 16 De Crespigny Park, London, SE5 8AF, UK.  
E-mail address: [helen.2.fisher@kcl.ac.uk](mailto:helen.2.fisher@kcl.ac.uk) (H.L. Fisher).

<https://doi.org/10.1016/j.jpsychires.2018.06.011>

Received 6 April 2018; Received in revised form 8 June 2018; Accepted 11 June 2018

0022-3956/ © 2018 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

factors that increase rather than decrease risk. This is despite calls for a shift towards investigating what enables some victimized individuals to avoid developing psychotic experiences in the hope that such findings could inform preventive interventions (Morgan and Gayer-Anderson, 2016). In a recent study (Crush et al., 2017), we found that having a relatively high IQ, a more positive atmosphere at home, and higher levels of neighborhood social cohesion (meaning neighbors get along well and share common values) were associated with a reduced likelihood of psychotic symptoms emerging at age 12 amongst poly-victimized children. The current paper extends these findings by considering whether similar factors are protective amongst individuals exposed to poly-victimization during adolescence in relation to psychotic experiences at age 18. Moreover, the wider literature suggests that some additional factors may be protective during this period including: positive coping strategies (Jalbrzikowski et al., 2014; Kommesch et al., 2016), engagement in physical activity (Callaghan, 2004; Suetani et al., 2017), and social support in terms of both perceived practical and emotional support from others and the number of social connections (Gayer-Anderson et al., 2015; Gayer-Anderson and Morgan, 2013; Hodges et al., 1999), and therefore these putative protective factors will also be investigated in the current study.

This paper utilises data from a large, nationally-representative UK birth cohort to explore whether individual (higher IQ, positive coping strategies, higher levels of physical activity), family (positive home atmosphere), community (socially cohesive neighborhood), and cross-level (greater perceived social support) factors are associated with a reduced likelihood of developing psychotic experiences in our population sample. We considered whether any of these factors were found to be protective in the context of poly-victimization during adolescence by (i) repeating analyses in this sub-sample, and (ii) testing for interactions between poly-victimization and putative protective factors in relation to an absence of age-18 psychotic experiences in the whole sample.

## 2. Materials and methods

### 2.1. Study cohort

Participants were members of the Environmental Risk (E-Risk) Longitudinal Twin Study, which tracks the development of a nationally-representative birth cohort of 2232 British twin children born in England and Wales in 1994–1995. Full details about the sample are reported elsewhere (Moffitt and The E-Risk Team, 2002), and in the Supplementary Materials. Briefly, the E-Risk sample was constructed in 1999–2000, when 1116 families with same-sex 5-year-old twins (93% of those eligible) participated in home-visit assessments. Families were recruited to represent the UK population of families with newborns in the 1990s, based on residential location throughout England and Wales and mothers' age. E-Risk families are representative of UK households across the spectrum of neighborhood-level deprivation (see Supplementary Materials). The sample comprised 56% monozygotic and 44% dizygotic twin pairs, and sex was evenly distributed within zygosity (49% male). Follow-up home-visits were conducted when children were aged 7, 10, 12, and 18 years (participation rates were 98%, 96%, 96%, and 93% respectively). The Joint South London and Maudsley and the Institute of Psychiatry Research Ethics Committee approved each phase of the study. Parents gave informed consent and twins gave assent between 5 and 12 years and then informed consent at age 18.

### 2.2. Measures

#### 2.2.1. Individual-level protective factors

**2.2.1.1. IQ.** The Wechsler Intelligence Scale for Children (WISC) (Wechsler, 2003) was used to assess IQ at age 12. Children were administered 3 tasks: matrix reasoning, information and digit span. The three scores were combined to create an overall scale and then standardized with a mean of 100 and standard deviation of 15.

**2.2.1.2. Coping strategies.** Coping was assessed at age 18 by asking participants about which strategies they used when experiencing stress in relation to finances, relationships, college or work. Four positively-coded items (“talk with other people about it”, “talk with a therapist or counsellor”, “exercise” and “take steps to solve the problem”) were combined to create a scale with higher scores reflecting more positive coping strategies.

**2.2.1.3. Physical activity.** At age 18, participants completed the Stanford Brief Activity Survey (SBAS; Stanford University, 2001). The SBAS contains 2 items, the first item relates to the extent of physical activity engaged in at work, school or college and the second refers to physical activity during leisure time. Both questions were rated on a 5-point scale: inactive, low intensity, moderate intensity, hard intensity and very hard intensity. The scales were then combined to derive an overall activity measure (Taylor-Piliae et al., 2010). For the current study, we used a binary variable for the analysis which compared those who were inactive (rating of 1) to those who were active (rating of 2–5).

#### 2.2.2. Family-level protective factors

**2.2.2.1. Atmosphere at home.** The creation of the atmosphere at home measure has been previously documented (Kim-Cohen et al., 2006). Briefly, it was derived from the Coder's Impression Inventory, which is based on the Home Observation for Measurement of the Environment (HOME) (Bradley and Caldwell, 1977) and the University of Washington Parenting Clinic Questionnaire (Parent–Child Observations) (Webster-Stratton, 1998). The Coder's Impression Inventory was rated by interviewers, who had undergone four-day training, immediately following the study visit with mothers when the twins were aged 12. This measure comprised items representing the state of the home (e.g., ‘Are visible rooms of the house clean?’), stimulation (e.g., ‘Is the children's art displayed in the home?’), happiness (e.g., ‘Is this a happy home?’), and chaos (e.g., ‘Is the house chaotic or overly noisy?’). The internal consistency between items was  $\alpha = 0.76$ .

#### 2.2.3. Community-level protective factors

**2.2.3.1. Social cohesion.** Social cohesion was estimated via a postal survey sent to residents living alongside E-Risk families when participants were aged 13–14 (Odgers et al., 2009, 2012). Survey respondents, who were typically living on the same street or within the same apartment block as the participants in our study, reported on various characteristics of their immediate neighborhood. Five items (each coded 0–4) were assessed including the questions: “is this a close-knit neighborhood”, “do you think people in this neighborhood can be trusted”, “do you share the same values”, etc. We derived a total scale by summing the answers to all 5 questions with higher scores indicative of greater social cohesion.

#### 2.2.4. Cross-level protective factors

**2.2.4.1. Social support.** Social support was assessed using the Multidimensional Scale of Perceived Social Support (MSPSS), which assesses individuals' access to supportive relationships with family, friends and significant others (Zimet et al., 1988). The 12 items in the MSPSS consist of statements such as “There is a special person who is around when I am in need” and “I can count on my friends when things go wrong”. Participants rated these statements as “not true” (0), “somewhat true” (1) or “very true” (2). We summed scores to produce an overall social support scale with higher scores reflecting greater social support (internal consistency:  $\alpha = 0.88$ ). In addition, each of the three sub-scales was utilized separately to examine whether social support from either family, friends or significant others was found to be specifically protective.

### 2.2.5. Adolescent psychotic phenomena

The present study uses two measures of psychotic phenomena which were both obtained from private interviews when participants were aged 18. Our primary outcome was a self-report measure of adolescent psychotic experiences which reflects the methodology used by many groups in the psychosis prodromal research field (Loewy et al., 2011). At age 18, each E-Risk participant was privately interviewed by a research worker about 13 psychotic experiences occurring since age 12. Seven items pertained to delusions and hallucinations and this interview has been described in detail previously (Polanczyk et al., 2010) and in the Supplementary Materials. Six items pertained to unusual experiences which drew on item pools since formalized in prodromal psychosis instruments including the PRIME-screen and SIPS (Loewy et al., 2011). These included “I worry that my food may be poisoned” and “My thinking is unusual or frightening”. Interviewers coded each item 0, 1, 2 indicating respectively “not present”, “probably present”, and “definitely present”. All 13 items were summed to create a psychotic experiences scale (range = 0–18,  $M = 1.19$ ,  $SD = 2.58$ ). Just over 30% of participants had at least one psychotic experience between ages 12 and 18 ( $n = 623$ , 30.2%). This is similar to the prevalence of self-reported psychotic experiences in other community samples of teenagers and young adults (Kelleher et al., 2012b; Yoshizumi et al., 2004). The presence (30.2%) versus absence (69.8%) of one or more “definitely present” psychotic experiences is used as a dichotomous dependent variable in the current study.

We additionally examined clinically-verified adolescent psychotic symptoms as a secondary outcome, using the same methodology as used at age 12 in this cohort (Polanczyk et al., 2010). Responses to the seven hallucination/delusion items were verified by a team of clinicians, including child and adolescent psychiatrists, to capture more clinically pertinent psychotic symptoms (see Supplementary Materials). At age 18, 2.9% ( $N = 59$ ) of participants were designated as having experienced at least 1 definite psychotic symptom.

### 2.2.6. Adolescent poly-victimization

At age 18, participants were interviewed about exposure to a range of adverse experiences between 12 and 18 years using the Juvenile Victimization Questionnaire, 2nd revision (JVQ-R2) (Finkelhor et al., 2011) adapted as a clinical interview, which has been outlined in a previous paper (Fisher et al., 2015) and described more fully in the Supplementary Materials. Each twin was interviewed by a different research worker, and each JVQ question was asked for the period ‘since you were 12’. Age 12 is a salient age for our participants because it is the age when British children leave primary school to enter secondary school. Our adapted JVQ comprised 45 questions covering 7 different forms of victimization: maltreatment, neglect, sexual victimization, family violence, peer/sibling victimization, internet/mobile phone victimization, and crime victimization. The worst experience (according to the participant) for each victimization type was rated by trained coders using a 6-point scale: 0 = not exposed, then 1–5 for increasing levels of severity. The adolescent poly-victimization variable was derived by summing all victimization experiences that received a code of ‘4’ or ‘5’ (i.e., severe exposure): 64.6% of adolescents had zero severe victimization experiences; 19.2% had 1; 9.4% had 2; 4.5% had 3; 1.5% had 4; 0.5% had 5; and 0.2% had 6 severe victimization experiences. Due to small numbers in some of the groups, we collapsed this variable into ‘0’ not victimized, ‘1’ experienced 1 type of severe victimization, and ‘2’ poly-victimized (experienced 2 or more types of severe victimization).

### 2.2.7. Potential confounders

Family socioeconomic status (SES) was measured via a composite of parental income (total household), education (highest for mother/father), and occupation (highest for mother/father) when children were aged 5 (Trzesniewski et al., 2006), and was categorized into tertiles (i.e., low-, medium-, and high-SES). Mothers reported on family history

of DSM disorders (Weissman, 2000) in private interviews when participants were aged 12, which was converted to a proportion (0–1.0) of family members with a history of psychiatric disorder (Milne et al., 2008). Childhood psychotic symptoms pertaining to seven delusions and hallucinations were measured when children were aged 12 during private interviews. Items and interviewer notes were assessed by a psychiatrist expert in schizophrenia, a psychologist expert in interviewing children, and a child and adolescent psychiatrist to verify the validity of the symptoms (Polanczyk et al., 2010). A total of 5.9% of children reported experiencing at least one definite psychotic symptom at age 12 ( $N = 125$ ). A variable was also created for the presence vs. absence of any childhood mental health problems to capture children who met criteria for extreme anxiety, clinically-relevant depression symptoms, attention deficit hyperactivity disorder (ADHD), or conduct disorder by age 12 (see Supplementary Materials).

### 2.3. Statistical analysis

Analyses were conducted in STATA 11.2 (Stata-Corp, College Station, TX). Because each study family contains two children, all statistical analyses were corrected conservatively for the non-independence of twin observations by using tests based on the Huber/White variance estimator (Williams, 2000). We used logistic regression to test the associations between individual, family, community, and cross-level factors and absence of age-18 psychotic experiences in (i) the whole sample and (ii) the sub-sample with adolescent poly-victimization. We also tested for interactions between poly-victimization and any factors found to be associated with an absence of age-18 psychotic experiences in the poly-victimized group using logistic regression to examine whether these factors were specifically protective in relation to poly-victimization exposure. All of these analyses were subsequently adjusted for gender, family SES, family psychiatric history, age-12 psychotic symptoms, and childhood mental health problems. Sensitivity analyses were also conducted using the rarer clinically-verified psychotic symptoms at age 18 as the outcome variable for analyses conducted in the whole sample.

## 3. Results

### 3.1. Are any individual, family or community-level factors associated with the absence of age-18 psychotic experiences in the whole sample?

First, we considered whether any of the factors were associated with a reduced likelihood of psychotic experiences emerging at age 18 in the whole sample (Table 1). We found that engaging in physical activity, higher levels of social cohesion, and greater levels of social support were all associated with a reduced likelihood of psychotic experiences being reported at age 18 when controlling for potential confounders. Furthermore, multivariate models including the above significant predictors showed that independent associations were found for engaging in physical activity ( $OR = 0.59$ , 95% CI 0.36–0.96,  $P = 0.035$ ), increased social support ( $OR = 0.91$ , 95% CI 0.89–0.94,  $P < 0.001$ ), and higher levels of social cohesion ( $OR = 0.77$ , 95% CI 0.60–0.98,  $P = 0.035$ ). When considered individually, each social support type was found to be protective: family ( $OR = 0.80$ , 95% CI 0.76–0.86,  $P < 0.001$ ), friends ( $OR = 0.83$ , 95% CI 0.78–0.88,  $P < 0.001$ ), and significant others ( $OR = 0.92$ , 95% CI 0.87–0.97,  $P = 0.004$ ), after controlling for all other significant factors. Broadly similar results were found when repeating analyses using clinically-verified psychotic symptoms (Table 2).

### 3.2. Is poly-victimization during adolescence associated with age-18 psychotic experiences?

Psychotic experiences at age 18 were more commonly reported by adolescents who were exposed to one type of victimization (41.0% vs.

**Table 1**

Associations between individual, family, and community factors in adolescence and age-18 psychotic experiences in the full sample.

Protective Factors	Whole Sample (N = 2063)			
	No Psychotic Experiences N = 1440 M (SD)	Psychotic Experiences N = 623 M (SD)	Unadjusted OR (95% CI)	Adjusted OR <sup>a</sup> (95% CI)
IQ at age 12	101.4 (14.9)	97.5 (14.6)	<b>0.98 (0.98–0.99)</b>	0.99 (0.99–1.00)
Physically active at age 18, n (%)	1396 (96.9)	575 (92.7)	<b>0.40 (0.26–0.62)</b>	<b>0.49 (0.30–0.77)</b>
Positive coping strategies at age 18	3.0 (1.7)	3.0 (1.7)	0.98 (0.92–1.04)	1.02 (0.95–1.08)
Atmosphere at home at age 12	24.2 (5.4)	22.9 (5.6)	<b>0.96 (0.94–0.98)</b>	0.99 (0.97–1.02)
Social cohesion at age 13/14	2.3 (0.5)	2.2 (0.5)	<b>0.66 (0.53–0.82)</b>	<b>0.78 (0.61–0.99)</b>
Social support at age 18	21.3 (3.9)	19.3 (5.0)	<b>0.90 (0.88–0.92)</b>	<b>0.91 (0.89–0.94)</b>

<sup>a</sup> Adjusted for family socioeconomic status, family psychiatric history, child's gender, age-12 psychotic symptoms, and other mental health problems at age 12. All analyses account for the non-independence of twin observations. CI, confidence interval. IQ, intelligence quotient. M, mean. OR, odds ratio. SD, standard deviation. Bold text indicates  $p < 0.05$ .

**Table 2**

Associations between individual, family, and community factors in adolescence and age-18 clinically-verified psychotic symptoms in the full sample.

Protective Factors	Whole Sample (N = 2063)		
	No Psychotic Symptoms N = 2004 M (SD)	Psychotic Symptoms N = 59 M (SD)	Unadjusted OR (95% CI)
IQ at age 12	100.3 (14.9)	97.6 (15.7)	0.99 (0.97–1.01)
Physically active at age 18, n (%)	1917 (95.9)	53 (89.8)	<b>0.38 (0.16–0.92)</b>
Coping strategies at age 18	3.0 (1.7)	3.4 (1.8)	1.15 (0.99–1.35)
Atmosphere at home at age 12	23.9 (5.5)	22.0 (5.5)	<b>0.95 (0.92–0.99)</b>
Social cohesion at age 13/14	2.2 (0.5)	2.1 (0.6)	<b>0.58 (0.34–0.99)</b>
Social support at age 18	20.8 (4.3)	18.2 (6.1)	<b>0.91 (0.86–0.95)</b>

All analyses account for the non-independence of twin observations. Due to the small number of individuals with psychotic symptoms, all analyses are presented without adjustment for potential confounders. CI, confidence interval. IQ, intelligence quotient. M, mean. OR, odds ratio. SD, standard deviation. Bold text indicates  $p < 0.05$ .

26.2%; OR = 1.96, 95% CI 1.57–2.45,  $P < 0.001$ ), and even more so amongst those exposed to two or more types (59.9% vs. 24.4%; OR = 4.62, 95% CI 3.59–5.94,  $P < 0.001$ ) compared to those not exposed to any victimization between 12 and 18 years. Given that the poly-victimized group had the greatest likelihood of reporting age-18 psychotic experiences we focussed our analysis on these high-risk adolescents. This association with poly-victimization remained after controlling for family SES (OR = 4.36, 95% CI 3.38–5.62,  $P < 0.001$ ), family psychiatric history (OR = 4.33, 95% CI 3.34–5.61,  $P < 0.001$ ), age-12 psychotic symptoms (OR = 4.31, 95% CI 3.33–5.60,  $P < 0.001$ ), and other mental health problems at age 12 (OR = 4.12, 95% CI 3.18–5.35,  $P < 0.001$ ). It also did not significantly differ for boys and girls (sex interaction: OR = 1.73, 95% CI 0.75–3.99,  $P = 0.197$ ), and therefore we present all further results for both sexes together. In total, over a third of poly-victimized adolescents reported not having any psychotic experiences at age 18 (40.1%).

### 3.3. Are individual, family, and community-level factors associated with the absence of age-18 psychotic experiences amongst poly-victimized adolescents?

Next, we explored whether the factors significantly associated with an absence of psychotic experiences in the whole sample were protective amongst adolescents exposed to multiple forms of victimization

(Table 3). Only greater social support at age 18 was found to be significantly associated with a reduced likelihood of age-18 psychotic experiences amongst poly-victimized adolescents (OR = 0.93, 95% CI 0.88–0.98,  $P = 0.011$ ) after adjustment for a range of confounders. Physical activity also showed a strong trend with a reduced likelihood of psychotic experiences in the poly-victimized group after controlling for all confounders, albeit this association failed to meet conventional levels of statistical significance (OR = 0.49, 95% CI 0.18–1.26,  $P = 0.134$ ).

When considering the social support sub-scales separately, two of them were significantly associated with an absence of psychotic experiences among poly-victimized adolescents: support from family (OR = 0.83, 95% CI 0.73–0.94,  $P = 0.002$ ) and friends (OR = 0.89, 95% CI 0.81–0.98,  $P = 0.021$ ). Finally, we tested for an interaction between social support and poly-victimization to ascertain whether this was particularly protective against adolescent psychotic experiences in the context of poly-victimization exposure. However, we did not find this interaction to be significant (interaction OR = 1.00, 95% CI 0.94–1.07,  $P = 0.816$ ).

## 4. Discussion

This is the first study to investigate putative protective factors in relation to psychotic experiences amongst adolescents. We found that engaging in physical activity, greater social support, and more social cohesion within the surrounding neighborhood were associated with an absence of psychotic experiences at age 18 in this general population sample; these associations remained after controlling for a range of confounders including earlier mental health problems at age 12. These factors, together with a positive atmosphere at home, were also found to be associated with an absence of the rarer clinically-verified psychotic symptoms in the whole sample. However, when considering factors that were protective amongst the high-risk group exposed to poly-victimization, we only found greater social support to be protective against adolescent psychotic experiences.

The most notable finding is that social support consistently comes through as being independently associated with a reduced likelihood of adolescent psychotic experiences even in the context of poly-victimization, as well as in relation to the clinically-verified age-18 psychotic symptoms in the whole sample. The social support measure in this study is based upon adolescents' perceptions of the social support they receive from friends, family and significant others, and thus captures both subjective views of availability and functional aspects of social support (Valtorta et al., 2016). Our findings are consistent with previous research which has found social support to be associated with positive emotional and behavioural adjustment during adolescence, perhaps due to improvements in self-esteem (Smith et al., 2006; Turner et al., 2015) or reducing loneliness (Lim et al., 2018; Sündermann et al., 2014). Self-esteem is particularly relevant given that low self-esteem



**Table 3**

Associations between potential protective factors and age-18 psychotic experiences amongst adolescents exposed to poly-victimization.

Protective Factors	Poly-victimized adolescents (N = 334)			
	No Psychotic Experiences N = 134 M (SD)	Psychotic Experiences N = 200 M (SD)	Unadjusted OR (95% CI)	Adjusted OR <sup>a</sup> (95% CI)
Physically active at age 18, n (%)	128 (95.5)	178 (89.5)	0.40 (0.15–1.03)	0.48 (0.18–1.26)
Social cohesion at age 13/14	2.2 (0.4)	2.1 (0.6)	0.71 (0.45–1.13)	0.86 (0.52–1.42)
Social support at age 18	20.1 (5.0)	18.1 (5.4)	<b>0.92 (0.88–0.97)</b>	<b>0.93 (0.88–0.98)</b>

<sup>a</sup> Adjusted for family socioeconomic status, family psychiatric history, child's gender, age-12 psychotic symptoms, and other mental health problems at age 12. All analyses account for the non-independence of twin observations. CI, confidence interval. IQ, intelligence quotient. M, mean. OR, odds ratio. SD, standard deviation. Bold text indicates  $p < 0.05$ .

has been found to be predictive of psychotic phenomena in non-clinical populations previously (Krabbendam et al., 2002) and to mediate the association between victimization and psychotic experiences during adolescence (Fisher et al., 2013).

It has also been proposed that social support may play an important role in buffering stress levels (Cohen and Wills, 1985; Stadler et al., 2010) and relatedly has been found to be a key coping strategy for adolescents (Eschenbeck et al., 2007), which may also explain why social support was protective for those adolescents exposed to multiple forms of victimization. In addition, our findings are consistent with a study that found that social support may buffer the effects of some forms of victimization on adult psychosis (Gayer-Anderson et al., 2015). These findings suggest that social support is an important area to focus on to prevent the emergence of psychotic experiences in adolescence, which requires further research and clinical attention. However, it is also possible that adolescents who demonstrate resilience in the face of adversity are more attractive to others and thus have more friends and elicit greater social support so further investigation of the direction in which this association is operating is required.

Being physically active during work and leisure time was found to be independently associated with lower rates of adolescent psychotic experiences in the whole sample and also showed a strong (albeit non-significant) protective trend in the poly-victimised group. Our findings are consistent with a number of recent studies which have highlighted that inactivity during adolescence is associated with psychotic phenomena in early adulthood (Suetani et al., 2017) and the benefit of exercise interventions for reducing psychotic phenomena amongst those at risk for psychosis as well as clinical groups suffering from psychotic disorders and also depression (Dauwan et al., 2016; Firth et al., 2015, 2016). In terms of mechanisms through which exercise may reduce the likelihood of psychotic phenomena, it has been suggested these could be biological (stress buffering), psycho-social (social connectedness) and psychological (self-esteem), albeit further research is needed in relation to physical activity and psychotic phenomena to understand the association and mechanisms in more detail (Knowles, 2017). Finally, it is important to note that as our finding on physical activity and psychotic experiences is based on cross-sectional analyses we cannot draw any conclusions regarding the direction of the association. It is also plausible that negative symptoms (such as anhedonia and avolition), which may precede or accompany the positive psychotic experiences that we measured, could explain the lack of engagement in physical activity amongst those reporting psychotic phenomena.

#### 4.1. Limitations

Some limitations warrant consideration. Firstly, despite this being a large cohort, the number of poly-victimised adolescents was reasonably modest (N = 334) and this may have limited our ability to detect some associations between the proposed protective factors and a reduced likelihood of developing psychotic experiences, and particularly interaction effects. These analyses thus warrant replication in even larger

cohorts of victimized adolescents. Additionally, the self-report measure of adolescent psychotic experiences utilized for most of the analyses may have captured genuine experiences (e.g., being followed by a stranger) as well as psychotic phenomena (e.g., being followed by an angel). This may have led to inflated associations for adolescent psychotic experiences, though it is reassuring that the effect sizes were fairly similar to those produced for clinically-verified psychotic symptoms. Relatedly, the low numbers of individuals with clinically-verified psychotic symptoms meant that we lacked power to detect significant associations when using this outcome and were unable to look at it in the poly-victimised group. It is also important to note that it was not possible to identify the specific timing of victimization exposure within the 6-year period and therefore we were not able to look at timing in further detail.

The social support scale used is a self-report measure reflecting individuals' perceptions of support from friends, family and significant others, thus it is possible that individuals who develop psychotic experiences may perceive their support levels to be lower than the support that is actually available and therefore we welcome replication of our findings amongst cohorts with co-informant measures of social support in order to understand this association more clearly. Finally, the E-Risk cohort comprises twins, and whether findings from twin studies generalize to singletons is sometimes contested. However, the adolescents in our study reported a similar prevalence of psychotic experiences (Horwood et al., 2008; Scott et al., 2006; Yoshizumi et al., 2004) and victimization (Radford et al., 2013) to those found for singletons, and are representative of UK families in terms of geographic and socioeconomic distribution (Moffitt and The E-Risk Team, 2002; CACI, 2006).

#### 5. Conclusion

Greater social support, higher levels of neighborhood social cohesion, and engaging in physical activity were all found to be associated with a reduced likelihood of having adolescent psychotic experiences in the full sample. Greater social support (and to a non-significant degree physical activity) also showed strong protective effects in the context of poly-victimization. Our findings have implications for the potential focus and timing of early interventions. Our research suggests interventions focused on improving individual's social support from friends and family or how they perceive existing social support around them as well as increasing physical activity could be effective in reducing psychotic phenomena, and that these interventions should be targeted at poly-victimised adolescents who are at greatest risk for developing psychotic experiences. It is encouraging that increasing the availability of social support and improving physical activity levels constitute interventions that would be feasible to implement on both the population-level and amongst high-risk groups.

## Financial support

The E-Risk Study is funded by the UK Medical Research Council (G1002190). Additional support was provided by the National Institute of Child Health and Human Development (HD077482); the Jacobs Foundation; the Avielle Foundation; a research grant from the National Society for Prevention of Cruelty to Children (NSPCC) and Economic and Social Research Council; a Medical Research Council Studentship to EC; and an MQ Transforming Mental Health (MQ14F40) Fellows Award to HLF. LA is the Mental Health Leadership Fellow for the UK ESRC.

## Conflicts of interest

None.

## Acknowledgements

We are grateful to the study mothers and fathers, the twins, and the twins' teachers for their participation. Our thanks to CACI, Inc., and to members of the E-Risk team for their dedication, hard work and insights.

## Appendix A. Supplementary data

Supplementary data related to this article can be found at <http://dx.doi.org/10.1016/j.jpsychires.2018.06.011>.

## References

- Arseneault, L., Cannon, M., Fisher, H.L., Polanczyk, G., Moffitt, T.E., Caspi, A., 2011. Childhood trauma and children's emerging psychotic symptoms: a genetically sensitive longitudinal cohort study. *Am. J. Psychiatr.* 168, 65–72.
- Bradley, R., Caldwell, B., 1977. Home Observation for Measurement of the Environment: a validation study of screening efficiency. *Am. J. Ment. Defic.* 81, 417–420.
- CACI Information Services, 2006. ACORN User Guide. London.
- Callaghan, P., 2004. Exercise: a neglected intervention in mental health care? *J. Psychiatr. Ment. Health Nurs.* 11 (4), 476–483.
- Cohen, S., Wills, T.A., 1985. Stress, social support, and the buffering hypothesis. *Psychol. Bull.* 98 (2), 310–357.
- Crush, E., Arseneault, L., Jaffee, S., Danese, A., Fisher, H.L., 2017. Protective factors for psychotic symptoms amongst poly-victimised children. *Schizophr. Bull.* <http://dx.doi.org/10.1093/schbul/sbx111>.
- Dauwan, M., Begemann, M.J.H., Heringa, S.M., Sommer, I.E., 2016. Exercise improves clinical symptoms, quality of life, global functioning, and depression in schizophrenia: a systematic review and meta-analysis. *Schizophr. Bull.* 42 (3), 588–599.
- Dominguez, M.D.G., Wichers, M., Lieb, R., Wittchen, H.U., van Os, J., 2011. Evidence that onset of clinical psychosis is an outcome of progressively more persistent subclinical psychotic experiences: an 8-year cohort study. *Schizophr. Bull.* 37 (1), 84–93.
- Eschenbeck, H., Kohlmann, C.W., Lohaus, A., 2007. Gender differences in coping strategies in children and adolescents. *J. Indiv. Differ.* 28 (1), 18–26.
- Finkelhor, D., Hamby, S.L., Turner, H., Ormrod, R., 2011. The Juvenile Victimization Questionnaire: 2nd Revision (JVQ-R2). Crimes Against Children Research Center, Durham, NH.
- Finkelhor, D., Ormrod, R.K., Turner, H.A., 2007. Poly-victimization: a neglected component in child victimization. *Child Abuse Negl.* 31, 7–26.
- Firth, J., Carney, R., Elliott, R., French, P., Parker, S., McIntyre, R., McPhee, J.S., Yung, A.R., 2016. Exercise as an intervention for first-episode psychosis: a feasibility study. *Early Interv. Psychiatr.* <http://dx.doi.org/10.1111/eip.12329>.
- Firth, J., Cotter, J., Elliott, R., French, P., Yung, A.R., 2015. A systematic review and meta-analysis of exercise interventions in schizophrenia patients. *Psychol. Med.* 45 (7), 1343–1361.
- Fisher, H.L., Caspi, A., Moffitt, T.E., Wertz, J., Gray, R., Newbury, J., Ambler, A., Zavos, H., Danese, A., Mill, J., Odgers, C.L., Pariante, C., Wong, C.C., Arseneault, L., 2015. Measuring adolescents' exposure to victimization: the environmental risk (E-Risk) longitudinal twin study. *Dev. Psychopathol.* 27, 1399–1416.
- Fisher, H.L., Schreier, A., Zammit, S., Maughan, B., Munafo, M., Lewis, G., Wolke, D., 2013. Pathways between childhood victimization and psychosis-like symptoms in the ALSPAC birth cohort. *Schizophr. Bull.* 39 (5), 1045–1055.
- Gayer-Anderson, C., Fisher, H.L., Fearon, P., Hutchinson, G., Morgan, K., Dazzan, P., Morgan, C., 2015. Gender differences in the association between childhood physical and sexual abuse, social support and psychosis. *Soc. Psychiatr. Psychiatr. Epidemiol.* 50 (10), 1489–1500.
- Gayer-Anderson, C., Morgan, C., 2013. Social networks, support and early psychosis: a systematic review. *Epidemiol. Psychiatr. Sci.* 22 (2), 131–146.
- Hodges, A., Byrne, M., Grant, E., Johnstone, E., 1999. People at risk of schizophrenia. Sample characteristics of the first 100 cases in the Edinburgh high-risk study. *Br. J. Psychiatry* 174, 547–553.
- Horwood, J., Salvi, G., Thomas, K., Duffy, L., Gunnell, D., Hollis, C., Lewis, G., Menezes, P., Thompson, A., Wolke, D., Zammit, S., Harrison, G., 2008. IQ and non-clinical psychotic symptoms in 12-year-olds: results from the ALSPAC birth cohort. *Br. J. Psychiatry* 193, 185–191.
- Jalbrzikowski, M., Sugar, C.A., Zinberg, J., Bachman, P., Cannon, T.D., Bearden, C.E., 2014. Coping styles of individuals at clinical high risk for developing psychosis. *Early Interv. Psychiatr.* 8, 68–76.
- Kelleher, I., Keeley, H., Corcoran, P., Lynch, F., Fitzpatrick, C., Devlin, N., Molloy, C., Roddy, S., Clarke, M.C., Harley, M., Arseneault, L., Wasserman, C., Carli, V., Sarchiapone, M., Hoven, C., Wasserman, D., Cannon, M., 2012a. Clinicopathological significance of psychotic experiences in non-psychotic young people: evidence from four population-based studies. *Br. J. Psychiatry* 201 (1), 26–32.
- Kelleher, I., Connor, D., Clarke, M.C., Devlin, N., Harley, M., Cannon, M., 2012b. Prevalence of psychotic symptoms in childhood and adolescence: a systematic review and meta-analysis of population-based studies. *Psychol. Med.* 42, 1857–1863.
- Kelleher, I., Keeley, H., Corcoran, P., Ramsay, H., Wasserman, C., Carli, V., Sarchiapone, M., Hoven, C., Wasserman, D., Cannon, M., 2013. Childhood trauma and psychosis in a prospective cohort study: cause, effect, and directionality. *Am. J. Psychiatr.* 170, 734–741.
- Kim-Cohen, J., Caspi, A., Taylor, A., Williams, B., Newcombe, R., Craig, I.W., Moffitt, T.E., 2006. MAOA, maltreatment, and gene-environment interaction predicting children's mental health: new evidence and a meta-analysis. *Mol. Psychiatr.* 11, 903–913.
- Knowles, G., 2017. Physical activity and mental health: commentary on Suetani et al. 2016: common mental disorders and recent physical activity status: findings from a National Community Survey. *Soc. Psychiatr. Psychiatr. Epidemiol.* 52 (7), 803–805.
- Kommesch, M., Wagner, M., Pützfeld, V., Berning, J., Janssen, B., Decker, P., Bottlender, R., Möller, H.J., Gaebel, W., Maier, W., Klosterkötter, J., Bechdolf, A., 2016. Coping as a predictor of treatment outcome in people at clinical high risk of psychosis. *Early Interv. Psychiatr.* 10, 17–27.
- Krabbendam, L., Janssen, I., Bak, M., Bijl, R.V., de Graaf, R., van Os, J., 2002. Neuroticism and low self-esteem as risk factors for psychosis. *Soc. Psychiatr. Psychiatr. Epidemiol.* 37 (1), 1–6.
- Lim, M.H., Gleeson, J.F.M., Alvarez-Jimenez, M., Penn, D.L., 2018. Loneliness in psychosis: a systematic review. *Soc. Psychiatry Psychiatr. Epidemiol.* 53 (3), 221–238.
- Loewy, R.L., Pearson, R., Vinogradov, S., Bearden, C.E., Cannon, T.D., 2011. Psychosis risk screening with the Prodromal Questionnaire-brief version (PQ-B). *Schizophr. Res.* 129 (1), 42–46.
- McGrath, J.J., Saha, S., Al-hamzawi, A., Andrade, L., Benjet, C., Bromet, E.J., Browne, M.O., Caldas de Almeida, J.M., Chiu, W.T., Demyttenaere, K., Fayyad, J., Florescu, S., de Girolamo, G., Gureje, O., Haro, J.M., Ten Have, M., Hu, C., Kovess-Masfety, V., Lim, C.C., Navarro-Mateu, F., Sampson, N., Posada-Villa, J., Kessler, K.S., Kessler, R.C., 2016. The bi-directional associations between psychotic experiences and DSM-IV mental disorders. *Am. J. Psychiatr.* 173 (10), 997–1006.
- Milne, B.J., Moffitt, T.E., Crump, R., Poulton, R., Rutter, M., Sears, M.R., Taylor, A., Caspi, A., 2008. How should we construct psychiatric family history scores? A comparison of alternative approaches from the Dunedin Family Health History Study. *Psychol. Med.* 38 (12), 1793–1802.
- Moffitt, T.E., The E-Risk Team, 2002. Teen-aged mothers in contemporary Britain. *JCPP (J. Child Psychol. Psychiatr.)* 43 (5), 1–16.
- Morgan, C., Gayer-Anderson, C., 2016. Childhood adversities and psychosis: evidence, challenges, implications. *World Psychiatry* 15, 93–102.
- Odgers, C.L., Caspi, A., Bates, C.J., Sampson, R.J., Moffitt, T.E., 2012. Systematic social observation of children's neighborhoods using Google Street View: a reliable and cost-effective method. *JCPP (J. Child Psychol. Psychiatr.)* 53 (10), 1009–1017.
- Odgers, C.L., Moffitt, T.E., Tach, L.M., Sampson, R.J., Taylor, A., Matthews, C.L., Caspi, A., 2009. The protective effects of neighborhood collective efficacy on British children growing up in deprivation: a developmental analysis. *Dev. Psychol.* 45 (4), 942–957.
- Polanczyk, G., Moffitt, T., Arseneault, L., Cannon, M., Ambler, A., Keefe, R.S., Houts, R., Odgers, C.L., Caspi, A., 2010. Etiological and clinical features of childhood psychotic symptoms. *Arch. Gen. Psychiatr.* 67, 328–338.
- Radford, L., Corral, B., Bradley, C., Fisher, H.L., 2013. The prevalence and impact of child maltreatment and other types of victimization in the UK: findings from a population survey of caregivers, children and young people and young adults. *Child Abuse Negl.* 37 (10), 801–813.
- Stadler, C., Feifel, J., Rohrmann, S., Vermeiren, R., Poustka, F., 2010. Peer-victimization and mental health problems in adolescents: are Parental and school support protective? *Child Psychiatr. Hum. Dev.* 41 (4), 371–386.
- Stanford University, 2001. Stanford Brief Activity Survey. Stanford University, California.
- Scott, J., Chant, D., Andrews, G., McGrath, J., 2006. Psychotic-like experiences in the general community: the correlates of CIDI psychosis screen items in an Australian sample. *Psychol. Med.* 36 (2), 231–238.
- Smith, B., Fowler, D.G., Freeman, D., Bebbington, P., Bashford, H., Garety, P., Dunn, G., Kuipers, E., 2006. Emotion and psychosis: links between depression, self-esteem, negative schematic beliefs and delusions and hallucinations. *Schizophr. Res.* 86 (1–3), 181–188.
- Suetani, S., Mamun, A., Williams, G.M., Najman, J.M., John, J., Scott, J.G., 2017. Longitudinal association between physical activity engagement during adolescence and mental. *J. Psychiatr. Res.* 94, 116–123.
- Sündermann, O., Onwumere, J., Kane, F., Morgan, C., Kuipers, E., 2014. Social networks and support in first-episode psychosis: exploring the role of loneliness and anxiety. *Soc. Psychiatr. Psychiatr. Epidemiol.* 49 (3), 359–366.
- Taylor-Piliae, R.E., Fair, J.M., Haskell, W.L., Varady, A.N., Iribarren, C., Hlatky, M.A., Go, A.S., Fortmann, S.P., 2010. Validation of the Stanford Brief Activity Survey: examining psychological factors and physical activity levels in older adults. *J. Phys. Activ. Health* 7, 87–94.

- Trzesniewski, K.H., Moffitt, T.E., Taylor, A., Maughan, B., 2006. Revisiting the association between reading achievement and antisocial behavior: new evidence of an environmental explanation from a twin study. *Child Dev.* 77 (1), 72–88.
- Turner, H.A., Shattuck, A., Finkelhor, D., Hamby, S., 2015. Effects of poly-victimization on adolescent social support, self-concept, and psychological distress. *J. Interpers. Violence* 32 (5), 755–780.
- Valtorta, N.K., Kanaan, M., Gilbody, S., Hanratty, B., 2016. Loneliness, social isolation and social relationships: what are we measuring? A novel framework for classifying and comparing tools. *BMJ Open* 6 (4), 1–7.
- Webster-Stratton, C., 1998. Preventing conduct problems in Head Start children: strengthening parenting competencies. *J. Consult. Clin. Psychol.* 66 (5), 715–730.
- Wechsler, D., 2003. Wechsler Intelligence Scale for Children - Fourth Edition UK Version. Harcourt Assessment, San Antonio, TX.
- Weissman, M.M., 2000. Brief screening for family psychiatric history: the Family History Screen. *Arch. Gen. Psychiatr.* 57 (7), 675–682.
- Williams, R.L., 2000. A note on robust variance estimation for cluster-correlated data. *Biometrics* 56 (2), 645–646.
- Yoshizumi, T., Murase, S., Honjo, S., Kaneko, H., Murakami, T., 2004. Hallucinatory experiences in a community sample of Japanese children. *J. Am. Acad. Child Adolesc. Psychiatr.* 43 (8), 1030–1036.
- Zimet, G., Powell, S., Farley, G., Werkman, S., Berkoff, K., 1988. Psychometric characteristics of the multidimensional scale of perceived social support. *J. Pers. Assess.* 55 (3), 610–617.

### 5.1.1 Chapter 5 (Part 1): Supplementary Materials

#### Study Cohort

Participants were members of the Environmental Risk (E-Risk) Longitudinal Twin Study, which tracks the development of a nationally-representative birth cohort of 2232 British twin children. The sample was drawn from a larger cohort of twins born in England and Wales in 1994-1995.<sup>1</sup> Full details about the sample are reported elsewhere.<sup>2</sup> Briefly, the E-Risk sample was constructed in 1999-2000, when 1116 families with same-sex 5-year-old twins (93% of those eligible) participated in home-visit assessments. Families were recruited to represent the UK population of families with newborns in the 1990s, based on residential location throughout England and Wales and mothers' age. Teenaged mothers with twins were over-selected to replace high-risk families who were selectively lost to the register through non-response. Older mothers having twins via assisted reproduction were under-selected to avoid an excess of well-educated older mothers. E-Risk families are representative of UK households across the spectrum of neighborhood-level deprivation: 25.6% of E-Risk families live in "wealthy achiever" neighborhoods compared to 25.3% of households nation-wide; 5.3% vs 11.6% live in "urban prosperity" neighborhoods; 29.6% vs 26.9% live in "comfortably off" neighborhoods; 13.4% vs 13.9% live in "moderate means" neighborhoods; and 26.1% vs 20.7% live in "hard-pressed" neighborhoods.<sup>3,4</sup> E-Risk families under-represent "urban prosperity" neighborhoods because such households are likely to be childless. The sample comprised 56% monozygotic and 44% dizygotic twin pairs, and sex was evenly distributed within zygosity (49% male). All families were English speaking, and the majority (93.7%) were White.

Follow-up home visits were conducted when children were 7 years (98% of the 1116 E-Risk Study families participated), 10 years (96% participation), 12 years (96% participation) and 18 years (93% participation). Home visits at ages 5, 7, 10, and 12 years included assessments with participants as well as their mother (or primary caretaker); the home visit at age 18 included interviews only with the participants. Each twin participant was assessed by a different interviewer. The average age of the twins at the time of the age 18 assessment was 18.4 years ( $SD=0.36$ ); all interviews were conducted after the 18<sup>th</sup> birthday. There were no differences between those who did and did not take part at age 18 in terms of socioeconomic status (SES) assessed when the cohort was initially defined ( $\chi^2=0.86$ ,  $p=0.65$ ), age-5 IQ scores ( $t=0.98$ ,  $p=0.33$ ), or age-5 internalizing or externalizing behavior problems ( $t=0.40$ ,  $p=0.69$  and  $t=0.41$ ,  $p=0.68$ , respectively). The Joint South London and Maudsley and the Institute of Psychiatry Research Ethics Committee approved each phase of the study.



Parents gave informed consent, and participants gave assent at ages 5-12 and informed consent at age 18.

### **Measure of clinically-verified psychotic symptoms**

E-Risk Study members were visited by mental health trainees or professionals when they were aged 18.<sup>5</sup> Each adolescent was privately interviewed about whether they had experienced 7 psychotic symptoms pertaining to delusions and hallucinations since age 12, with items including “have other people read your thoughts?,” “have you thought you were being followed or spied on?,” and “have you heard voices that other people cannot hear?.” This interview has been described in detail previously,<sup>5</sup> and was used at age 12 to estimate childhood psychotic symptoms. The item choice was guided by the Dunedin Study’s age-11 interview protocol<sup>6</sup> and an instrument prepared for the Avon Longitudinal Study of Parents and Children.<sup>7</sup> At age 18 (and 12) interviewers coded each experience 0, 1, 2 indicating respectively “not a symptom,” “probable symptom,” and “definite symptom.” A conservative approach was taken in designating an adolescent’s report as a symptom. First, the interviewer probed using standard prompts designed to discriminate between experiences that were plausible (e.g., “I was followed by a man after school”) and potential symptoms (e.g., “I was followed by an angel who guards my spirit”), and wrote down the adolescent’s narrative description of the experience. Second, items and interviewer notes were assessed by psychologists’ expert in assessing psychosis, and a child and adolescent psychiatrist to verify the validity of the symptoms. Third, because Study members were twins, experiences limited to the twin relationship (e.g., “My twin and I often know what each other are thinking”) were coded as “not a symptom”. Adolescents were only designated as having psychotic symptoms if they reported at least one definite and verified symptom. At age 18, 2.9% (N=59) of adolescents reported having psychotic symptoms since age 12. This is somewhat lower than the prevalence of psychotic symptoms in this sample at age 12 (5.9%, N=125), consistent with the attenuation of psychotic symptoms documented from childhood to adulthood.<sup>8,9</sup> Furthermore, our psychotic symptom measure has good construct validity, sharing many of the genetic, social, neurodevelopmental, and behavioural risks factors and correlates as adult schizophrenia.<sup>5</sup>

### **Measure of childhood mental health problems**

A variable for childhood mental health problems was derived to capture children who met criteria for extreme anxiety, clinically-relevant depression symptoms, attention deficit

hyperactivity disorder (ADHD), or conduct disorder by age 12. Anxiety was assessed when children were aged 12, via private interviews using the 10-item version of the Multidimensional Anxiety Scale for Children (MASC).<sup>10</sup> An extreme anxiety group was formed with children who scored at or above the 95th percentile (N = 129, 6.1%). Depression symptoms were assessed at age 12 using the Children's Depression Inventory (CDI).<sup>11</sup> Children who scored 20 or more were deemed to have clinically significant depressive symptoms (N = 74, 3.5%). ADHD was assessed using the DSM-IV and the requirement of symptom onset prior to age 12 was met if parents or teachers reported more than 2 ADHD symptoms at ages 5, 7, 10, or 12 years. We derived diagnoses of conduct disorder on the basis of mothers' and teachers' reports of children's behaviour problems using the Achenbach family of instruments and additional DSM-IV items assessing conduct disorder which have previously been described.<sup>12</sup> Conduct disorder was assumed present if it was diagnosed at ages 5, 7, 10 or 12 years. This variable was dichotomised to distinguish between the presence of any of the above mental health problems (coded 1) versus the absence of any age 12 mental health problems (coded as 0).

### **Assessment of victimization in adolescence**

We have previously reported evidence on the reliability and validity of our measurement of adolescent victimization.<sup>13</sup> Here we summarize the method. Participants were interviewed about experiences between 12-18 years using the Juvenile Victimization Questionnaire (JVQ),<sup>14,15</sup> adapted as a clinical interview. The JVQ has good psychometric properties<sup>16</sup> and was used in the U.K. National Society for the Prevention of Cruelty to Children national survey,<sup>17,18</sup> thereby providing benchmark values for comparisons with our cohort.

Within each pair of twins in our cohort, co-twins were interviewed separately by a different research worker and were assured of the confidentiality of their responses. The participants were advised that confidentiality would only be broken if they told the research worker that they were in immediate danger of being hurt, and in such situations the project leader would be informed and would contact the participant to discuss a plan for safety. We assessed 7 different forms of victimization: maltreatment, neglect, sexual victimization, family violence, peer/sibling victimization, internet/mobile phone victimization, and crime victimization. Each JVQ question was asked for the period 'since you were 12'. Participants were given the option to say "yes" or "no" as to whether each type of victimization had occurred in the reporting period. Research workers could rate each item "maybe" if the participant seemed unsure or hesitant in their response or they were not convinced that the

participant understood the question or was paying attention. Items rated as “maybe” were recoded as “no” or “yes” by the rating team based on the notes provided by the research workers. When insufficient notes were available, these responses were recoded conservatively as a “no”. Consistent with the JVQ manual,<sup>14,15</sup> participants were coded as 1 if they reported any experience within each type of victimization category, or 0 if none of the experiences within the category were endorsed. If an experience was endorsed within a victimization category, follow-up questions were asked concerning how old the participant was when it (first) happened, whether the participant was physically injured in the event, whether the participant was upset or distressed by the event; and how long it went on for (by marking the number of years on a Life History Calendar.<sup>19</sup> In addition, the interviewer wrote detailed notes based on the participant’s description of the worst event. If multiple experiences were endorsed within a victimization category, the participant was asked to identify and report about their worst experience.

All information from the JVQ interview was compiled into victimization dossiers. Using these dossiers, each of the seven victimization categories was rated by an expert in victimology and 3 other members of the E-Risk team who were trained on using the rating criteria. Ratings were made using a 6-point scale: 0 = not exposed, then 1-5 for increasing levels of severity. The anchor points for these ratings were adapted from the coding system used for the Childhood Experience of Care and Abuse interview (CECA),<sup>20,21</sup> which has good inter-rater reliability.<sup>20,22</sup> The CECA is a comprehensive semi-structured interview whose standardized coding system attempts to improve the objectivity of ratings by basing them on the coder’s perspective (rather than relying on the participant’s judgment) and focusing on concrete descriptions rather than perceptions or emotional responses to the questions, together with considering the context in which the adverse experience occurred.

In our adapted coding scheme, the anchor points of the scale differ for each victimization category, with some focused more on the severity of physical injury that is likely to have been incurred during victimization exposure (crime victimization, family violence, maltreatment), while others are more focused on the frequency of occurrence of victimization (peer/sibling victimization and internet/mobile phone victimization), the physical intrusiveness of the event (sexual victimization), or the pervasiveness of the effects of victimization (neglect). This reflects the different ways in which severity has previously been defined for different types of victimization.<sup>20,23</sup> (Given that our sample comprises twins, we also coded if any of the victimization events experienced by each twin had been perpetrated by their co-twin, as it is possible that growing up with a genetically related,

same-age child could increase or decrease sibling victimization rates.) Each twin's dossier was evaluated separately, and we did not use information provided in the co-twin's dossier about their own or shared victimization experiences to rate direct or witnessed violence exposure for the target twin. High levels of inter-rater reliability were achieved for the severity ratings for all forms of victimization: crime victimization (intra-class correlation coefficient [ICC] = 0.89,  $p < 0.001$ ), peer/sibling victimization (ICC = 0.91,  $p < 0.001$ ), internet/mobile phone victimization (ICC = 0.90,  $p < 0.001$ ), sexual victimization (ICC = 0.87,  $p < 0.001$ ), family violence (ICC = 0.93,  $p < 0.001$ ), maltreatment (ICC = 0.90,  $p < 0.001$ ), and neglect (ICC = 0.74,  $p < 0.001$ ).

The ratings for each type of victimization were then grouped into three classes: 0 – no exposure (score of 0), 1 – some exposure (score of 1, 2 or 3), and 2 – severe exposure (score of 4 or 5) due to small numbers for some of the rating points. Combining ratings of 4 and 5 is also consistent with previous studies using the CECA, which have collapsed comparable scale values to indicate presence of 'severe' abuse.<sup>20,22,24,25</sup> The adolescent poly-victimization variable was derived by summing all victimization experiences that received a code of '4' or '5' (i.e., severe exposure): 64.6% of adolescents had zero severe victimization experiences; 19.2% had 1; 9.4% had 2; 4.5% had 3; 1.5% had 4; 0.5% had 5; and 0.2% had 6 severe victimization experiences. Due to small numbers in some of the groups, we collapsed this variable into '0' not victimized, '1' experienced 1 type of severe victimization, and '2' poly-victimized (experienced 2 or more types of severe victimization).

## References

1. Trouton A, Spinath FM, Plomin R. Twins Early Development Study (TEDS): a multivariate, longitudinal genetic investigation of language, cognition and behavior problems in childhood. *Twin Res.* 2002;5(5):444-448.
2. Moffitt TE, E-Risk Study Team. Teen-aged mothers in contemporary Britain. *J Child Psychol Psychiatry.* 2002;43(5):1-16.
3. CACI. *ACORN user guide*. London, UK: CACI Information Services; 2006.
4. Caspi A, Taylor A, Moffitt TE, Plomin R. Neighborhood deprivation affects children's mental health: environmental risks identified in a genetic design. *Psychol Sci.* 2000;11(4):338-342.
5. Polanczyk G, Moffitt T, Arseneault L, et al. Etiological and clinical features of childhood psychotic symptoms. *Arch Gen Psychiatry.* 2010;67(4):328-338.
6. Poulton R, Caspi A, Moffitt TE, et al. Children's self-reported psychotic symptoms and adult schizophreniform disorder: a 15-year longitudinal study. *Arch Gen Psychiatry.* 2000;57:1053-1058.
7. Schreier A, Wolke D, Thomas K, et al. Prospective study of peer victimization in childhood and psychotic symptoms in a non-clinical population at age 12 years. *Arch Gen Psychiatry.* 2009;66:527-536.
8. Kelleher I, Connor D, Clarke MC, Devlin N, Harley M, Cannon M. Prevalence of psychotic symptoms in childhood and adolescence: a systematic review and meta-analysis of population-based studies. *Psychol Med.* 2012;42:1857-1863.
9. Zammit S, Kounali D, Cannon M, et al. Psychotic experiences and psychotic disorders at age 18 in relation to psychotic experiences at age 12 in a longitudinal population-based cohort study. *Am J Psychiatry.* 2013;170:742-750.
10. March JS, Parker JD, Sullivan K, et al. The Multidimensional Anxiety Scale for Children (MASC): factor structure, reliability, and validity. *J Am Acad Child Adolesc Psychiatry.* 1997;36(4):554-565.
11. Kovacs M. *Children's Depression Inventory (CDI) manual*. Multi-Health Systems; 1992.
12. Kim-Cohen J, Moffitt TE, Caspi A, Taylor A. Genetic and environmental processes in young children's resilience and vulnerability to socioeconomic deprivation. *Child Dev.* 2004;75(3):651-668.
13. Fisher HL, Caspi A, Moffitt TE, et al. Measuring adolescents' exposure to victimization: The Environmental Risk (E-Risk) Longitudinal Twin Study. *Dev Psychopathol.* 2005;27(Special Issue 4pt2):1399-1416.

14. Finkelhor D, Hamby SL, Turner HA, Ormrod RK. *The Juvenile Victimization Questionnaire: 2nd Revision (JVQ-R2)*. Durham, NH: Crimes Against Children Research Center; 2011.
15. Hamby S, Finkelhor D, Ormrod D, Turner H. *The comprehensive JVQ administration and scoring manual*. Durham, NH: University of New Hampshire, Crimes Against Children Research Center; 2004.
16. Finkelhor D, Hamby SL, Ormrod RK, Turner HA. The Juvenile Victimization Questionnaire: reliability, validity, and national norms. *Child Abuse Negl*. 2005;29:383-412.
17. Radford L, Corral S, Bradley C, Fisher H, Bassett C, Howat N, Collishaw S. *Child abuse and neglect in the UK today*. London: NSPCC; 2011.
18. Radford L, Corral S, Bradley C, Fisher HL. The prevalence and impact of child maltreatment and other types of victimization in the UK: findings from a population survey of caregivers, children and young people and young adults. *Child Abuse Negl*. 2013;37(10):801-813.
19. Caspi A, Moffitt TE, Thornton A, et al. The life history calendar: A research and clinical assessment method for collecting retrospective event-history data. *Int J Methods Psychiatr Res*. 1996;6:101-114.
20. Bifulco A, Brown GW, Harris TO. Childhood Experience of Care and Abuse (CECA): a retrospective interview measure. *J Child Psychol Psychiatry*. 1994;35(8):1419-1435.
21. Bifulco A, Brown GW, Neubauer A, Moran P, Harris T. *Childhood Experience of Care and Abuse (CECA) training manual*. London: Royal Holloway College, University of London; 1994.
22. Bifulco A, Brown GW, Lillie A, Jarvis J. Memories of childhood neglect and abuse: Corroboration in a series of sisters. *J Child Psychol Psychiatry*. 1997;38:365-374.
23. Barnett D, Manly JT, Cicchetti D. Defining child maltreatment: The interface between policy and research. In D Cicchetti & SL Toth (Eds.), *Child abuse, child development, and social policy* (pp. 7-74). Norwood, NJ: Ablex; 1993.
24. Bifulco A, Brown GW, Moran P, Ball C, Campbell C. Predicting depression in women: the role of past and present vulnerability. *Psychol Med*. 1998;28:39-50.
25. Fisher HL, Bunn A, Jacobs C, Moran P, Bifulco A. Concordance between mother and offspring retrospective reports of childhood adversity. *Child Abuse Negl*. 2011;35(2):117-122.

**Chapter 5 (Part 2): Girls get by with a little help from their friends:  
Gender differences in protective effects of social support for psychotic  
phenomena amongst poly-victimised adolescents**

This study was accepted for publication and therefore this chapter contains an exact copy of the published version.

**Reference:**

Crush, E., Arseneault, A., & Fisher, H.L. (2018). Girls get by with a little help from their friends: Gender differences in the protective effects of social support in relation to psychotic phenomena amongst poly-victimised adolescents. *Social Psychiatry & Psychiatric Epidemiology*, doi: 10.1007/s00127-018-1599-6.



# Girls get by with a little help from their friends: gender differences in protective effects of social support for psychotic phenomena amongst poly-victimised adolescents

Eloise Crush<sup>1</sup> · Louise Arseneault<sup>1</sup> · Helen L. Fisher<sup>1</sup>

Received: 8 June 2018 / Accepted: 18 September 2018 / Published online: 25 September 2018  
© The Author(s) 2018, corrected publication 2018

## Abstract

**Purpose** To investigate whether social support is protective for psychotic experiences similarly among poly-victimised adolescent girls and boys.

**Methods** We utilised data from the Environmental Risk (E-Risk) Longitudinal Twin Study, a nationally-representative sample of 2232 UK-born twins. Participants were privately interviewed at age 18 about victimisation, psychotic experiences, and social support during adolescence.

**Results** Perceived social support (overall and from friends) was found to be protective against psychotic experiences amongst poly-victimised adolescent girls, but not boys. Though boys were similarly protected by family support.

**Conclusions** Social support-focused interventions targeting psychotic phenomena amongst poly-victimised adolescents may be more effective for girls.

**Keywords** Psychosis · Psychotic-like experiences · Sex differences · Resilience · Victimization

## Introduction

A lack of social support has been associated with the emergence of psychotic symptoms (e.g., hearing voices or feeling very paranoid) in the general population [1, 2] and full-blown psychotic disorders [3]. Conversely, increased levels of perceived social support have been linked to an absence of psychotic experiences amongst adolescents at high risk due to exposure to multiple forms of victimisation (poly-victimised) [4]. Research has suggested that social support may buffer the effects of stress [5–8], improve self-esteem [9–11], and reduce feelings of loneliness [12, 13], which may all protect against psychotic phenomena.

Studies have commonly reported that social support is more strongly associated with an absence of psychopathology amongst adolescent girls [8, 14–18]. One study found social support buffered against psychotic disorders specifically amongst women exposed to physical abuse in childhood [19]. The current study aims to extend this work by exploring whether the protective effects of perceived social support vary by gender in relation to sub-clinical psychotic experiences amongst poly-victimised adolescents in the general population. In this study, we focus on adolescents' perceptions of the amount of social support they receive from friends, family and significant others, and thus capture both the perceived availability and also functional aspects of social support [20].

**Electronic supplementary material** The online version of this article (<https://doi.org/10.1007/s00127-018-1599-6>) contains supplementary material, which is available to authorized users.

✉ Helen L. Fisher  
helen.2.fisher@kcl.ac.uk

<sup>1</sup> King's College London, Social, Genetic and Developmental Psychiatry Centre, Institute of Psychiatry, Psychology and Neuroscience, London, UK

## Methods

### Study cohort

Participants were members of the Environmental Risk (E-Risk) Longitudinal Twin Study, a nationally-representative birth cohort of 2232 twin children born in England and Wales in 1994–1995. Full details about the sample



are reported elsewhere [21], and in the Supplementary Materials. Briefly, the E-Risk sample was constructed in 1999–2000, when 1116 families with same-sex 5-year-old twins (93% of those eligible) participated in home-visit assessments. Families were recruited to represent the UK population of families with newborns in the 1990s, based on residential location throughout England and Wales and mothers' age. The sample comprised 56% monozygotic and 44% dizygotic twin pairs, and sex was evenly distributed within zygosity (49% male). Follow-up home-visits were conducted when children were aged 7 (98% participation rate), 10 (96%), 12 (96%), and 18 years (93%).

### Adolescent poly-victimisation

At age 18, participants were interviewed about exposure to seven different forms of victimisation (crime, peer/sibling, internet/mobile phone, sexual, family violence, maltreatment and neglect) between 12 and 18 years using the Juvenile Victimization Questionnaire, 2nd revision (JVQ-R2) [22] adapted as a clinical interview [23]. The worst experience (according to the participant) for each victimisation type was rated by trained coders using a six-point scale: 0 = not exposed, then 1–5 for increasing levels of severity (see Supplementary Materials). The adolescent poly-victimisation variable was derived by summing all victimisation experiences that received a code of '4' or '5' (i.e., severe exposure). Due to small numbers in some of the groups, we collapsed this variable into '0' not victimised (64.6%), '1' experienced 1 type of severe victimisation (19.2%), and '2' poly-victimised (16.2%, experienced 2 or more types of severe victimisation).

### Adolescent psychotic phenomena

At age 18, each participant was privately interviewed about 13 psychotic experiences occurring since age 12. Seven items pertained to delusions and hallucinations and this interview has been described in detail previously [24] and in the Supplementary Materials. Six items pertained to unusual experiences which drew on item pools since formalised in prodromal psychosis instruments including the PRIME-screen and SIPS [25]. All 13 items were summed to create a psychotic experiences scale (range 0–18, M 1.19, SD 2.58). Just over 30% of participants reported at least 1 psychotic experience between ages 12 and 18 ( $N=623$ , 30.2%).

### Social support

Social support was assessed at age 18 using the Multidimensional Scale of Perceived Social Support (MSPSS), which assesses participants' access to supportive relationships with family, friends and significant others [26]. Participants rated

the 12 items as "not true" (0), "somewhat true" (1), or "very true" (2). We summed scores to produce an overall social support scale with higher scores reflecting greater social support (internal consistency:  $\alpha=0.88$ ). In addition, each of the three sub-scales was utilised separately to examine whether social support from either family, friends or significant others was found to be specifically protective.

### Potential confounders

Family socioeconomic status (SES) was measured when participants were aged 5 via a composite of parental income (total household), education (highest for mother/father), and occupation (highest for mother/father) [27], and was categorised into tertiles (i.e., low-, medium-, and high-SES). Mothers reported on family history of psychiatric disorders [28] in private interviews when participants were aged 12, which was converted to a proportion (0–1.0) of family members with a history of psychiatric disorder [29]. Childhood psychotic symptoms pertaining to 7 delusions and hallucinations were measured when participants were aged 12 during private interviews and verified by clinicians [24]. A total of 5.9% of the sample reported experiencing at least one definite psychotic symptom at age 12 ( $N=125$ ). A variable was also created for the presence vs. absence of any childhood mental health problems to capture children who met criteria for extreme anxiety, clinically-relevant depression symptoms, attention deficit hyperactivity disorder (ADHD), or conduct disorder by age 12 (see Supplementary Materials).

### Statistical analysis

We used logistic regression to test the association between (1) poly-victimisation and psychotic experiences at age 18, and (2) social support and age-18 psychotic experiences among all participants exposed to poly-victimisation ( $N=334$ ) and then separately for boys and girls. We tested for gender differences in the association between social support and psychotic experiences by including a 'gender  $\times$  social support' interaction term in the regression analysis. All of these analyses were adjusted for family SES, family psychiatric history, age-12 psychotic symptoms, and childhood mental health problems. Analyses were conducted in STATA 11.2 (Stata-Corp, College Station, TX, USA). Because each study family contains two children, all statistical analyses were corrected conservatively for the non-independence of twin observations using tests based on the Huber/White variance estimator [30].

## Results

Poly-victimisation was associated with an increased likelihood of psychotic experiences at age 18 after controlling for confounders (OR 3.81; 95% CI 2.92–4.97). There were no differences in this association between boys and girls (interaction OR 0.76; 95% CI 0.44–1.30).

Higher perceived levels of social support were found to be associated with a decreased likelihood of adolescent psychotic experiences amongst those exposed to poly-victimisation (OR 0.93; 95% CI 0.88–0.98). Next, we considered whether social support was protective for both boys and girls exposed to poly-victimisation (Table 1). We found a statistically significant interaction between gender and social support (interaction OR 0.88; 95% CI 0.79–0.98), such that total social support was only protective amongst girls (OR 0.88, 95% CI 0.82–0.94) but not boys (OR 0.99, 95% CI 0.92–1.07). None of the social support sub-types were significantly protective for adolescent boys, albeit there was a strong trend for family social support being protective (OR 0.83, 95% CI 0.66–1.04). Among the social support sub-types, gender differences were only statistically significant for the association between social support from friends and an absence of psychotic experiences (Table 1), with the protective effect evident for girls.

## Discussion

To our knowledge, this is the first study to investigate gender differences in the buffering effect of social support for psychotic experiences amongst poly-victimised adolescents in the general population. Broadly, our results suggest perceived social support is more protective amongst adolescent girls exposed to poly-victimisation, than amongst boys. Evidence was found for total perceived social support, and support from family and friends, to be protective in relation to psychotic experiences among girls exposed to multiple forms of victimisation. Amongst boys there was a strong trend for family support to be protective but the association failed to meet conventional levels of statistical significance.

Social support has been found to improve self-esteem particularly amongst girls [9] and, therefore, it is plausible that the protective nature of social support from friends and family for adolescent girls exposed to poly-victimisation in this sample can be explained in part due to improvements in self-esteem. Indeed, low self-esteem has been found to be predictive of psychotic phenomena in non-clinical populations [31] and has been shown to mediate associations between victimisation and adolescent psychotic experiences [32]. Relatedly, research has found girls rely on social support as a coping strategy more often than boys [33, 34], which may be particularly important for buffering stress related to poly-victimisation exposure.

Limitations should be considered. First, our cohort has a small number of adolescents exposed to poly-victimisation ( $N = 332$ ) which may have limited statistical power to

**Table 1** Associations between social support and age-18 psychotic experiences amongst adolescents exposed to poly-victimisation, split by gender

Social support subscale	Boys $N = 140$				Girls $N = 192$				Sex differences
	No psychotic experiences $N = 50$ $n$ (%)	Psychotic experiences $N = 90$ $n$ (%)	Unadjusted OR (95% CI)	Adjusted OR <sup>a</sup> (95% CI)	No psychotic experiences $N = 84$ $n$ (%)	Psychotic experiences $N = 108$ $n$ (%)	Unadjusted OR (95% CI)	Adjusted OR <sup>a</sup> (95% CI)	
Total	18.6 (6.2)	18.4 (4.9)	0.99 (0.92–1.07)	0.99 (0.92–1.07)	21.0 (3.9)	17.8 (5.7)	<b>0.87 (0.82–0.93)</b>	<b>0.88 (0.82–0.94)</b>	<b>0.88 (0.79–0.98)</b>
Family	6.6 (2.2)	5.7 (2.4)	0.84 (0.68–1.03)	0.83 (0.66–1.04)	6.7 (2.2)	5.5 (2.7)	<b>0.81 (0.71–0.93)</b>	<b>0.83 (0.72–0.96)</b>	1.00 (0.75–1.32)
Friends	5.6 (2.6)	5.9 (2.4)	1.06 (0.92–1.21)	1.06 (0.92–1.22)	6.9 (1.8)	5.4 (2.7)	<b>0.75 (0.65–0.87)</b>	<b>0.77 (0.66–0.89)</b>	<b>0.72 (0.59–0.89)</b>
Significant others	6.4 (2.5)	6.7 (2.0)	1.06 (0.90–1.24)	1.07 (0.89–1.28)	7.4 (1.5)	6.9 (2.0)	0.86 (0.72–1.03)	0.86 (0.71–1.03)	0.79 (0.61–1.02)

Bold text indicates  $p < 0.05$

OR odds ratio, CI confidence interval

<sup>a</sup>Controlling for family socioeconomic status, family psychiatric history, age-12 psychotic symptoms, other mental health problems at age 12, and the non-independence of twin observations

detect interactions between gender and perceived social support. In particular, the sample size may have prevented the identification of a significant effect of support from family being protective for boys. In addition, our psychotic experiences measure was self-report and, therefore, may have captured genuine experiences. Finally, our social support and psychotic experiences measures were both collected at age 18 and, therefore, it is not possible to infer the directionality of the association between them.

If replicated in larger cohorts, our findings have potential implications for interventions to prevent psychotic phenomena developing amongst adolescents exposed to poly-victimisation. Whilst social support represents a practically relevant and promising area for intervention efforts, it is possible that such interventions may be more relevant to girls and alternative strategies (or those focused on improving family support) might be more effective for boys.

**Acknowledgements** We are grateful to the study mothers and fathers, the twins, and the twins' teachers for their participation. Our thanks to Terrie E. Moffitt and Avshalom Caspi the founders of the E-Risk Study, CACI, Inc., and to members of the E-Risk team for their dedication, hard work and insights. The E-Risk Study is funded by the UK Medical Research Council (G1002190; and PhD Studentship to EC). Additional support was provided by the National Institute of Child Health and Human Development (HD077482); the Jacobs Foundation; the Avielle Foundation; a research grant from the National Society for the Prevention of Cruelty to Children (NSPCC) and Economic and Social Research Council (ESRC); and an MQ Fellows Award to HLF (MQ14F40). LA is the Mental Health Leadership Fellow for the UK ESRC.

## Compliance with ethical standards

**Conflict of interest** On behalf of all authors, the corresponding author states that there is no conflict of interest.

**Ethical approval** The Joint South London and Maudsley and the Institute of Psychiatry Research Ethics Committee approved each phase of the study. Parents gave informed consent and twins gave assent between 5 and 12 years and then informed consent at age 18.

**Open Access** This article is distributed under the terms of the Creative Commons Attribution 4.0 International License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made.

## References

- Wiles NJ, Zammit SG, Bebbington P, Singleton N, Meltzer H, Lewis G (2006) Self-reported psychotic symptoms in the general population: results from the longitudinal study of the British National Psychiatric Morbidity Survey. *Br J Psychiatry* 188:519–526
- Freeman D, McManus S, Brugha T, Meltzer H, Jenkins R, Bebbington P (2011) Concomitants of paranoia in the general population. *Psychol Med* 41(5):923–936
- Gayer-Anderson C, Morgan C (2013) Social networks, support and early psychosis: a systematic review. *Epidemiol Psychiatr Sci* 22(2):131–146
- Crush E, Arseneault L, Moffitt TE, Danese A, Caspi A, Jaffee J, Matthews T, Fisher HL (2018) Protective factors for psychotic experiences amongst adolescents exposed to multiple forms of victimization. *J Psychiatr Res* 104:32–38
- Cohen S, Wills TA (1985) Stress, social support, and the buffering hypothesis. *Psychol Bull* 98(2):310–357
- Olstad R, Sexton H, Sogaard AJ (2001) The Finnmark study. A prospective population study of the social support buffer hypothesis, specific stressors and mental distress. *Soc Psychiatry Psychiatr Epidemiol* 36(12):582–589
- Prinstein MJ, Guyer AE (2005) Peer victimization, cue interpretation, and internalizing symptoms: preliminary concurrent and longitudinal findings for children and adolescents. *J Clin Child Adolesc Psychol* 34(1):11–24
- Stadler C, Feifel J, Rohrmann S, Vermeiren R, Poustka F (2010) Peer-victimization and mental health problems in adolescents: are parental and school support protective? *Child Psychiatry Hum Dev* 41(4):371–386
- Bolognini M, Plancherel B, Bettischart W, Halfon O (1996) Self-esteem and mental health in early adolescence: development and gender differences. *J Adolesc* 19:233–245
- Smith B, Fowler DG, Freeman D, Bebbington P, Bashforth H, Garety P, Dunn G, Kuipers E (2006) Emotion and psychosis: links between depression, self-esteem, negative schematic beliefs and delusions and hallucinations. *Schizophr Res* 86:181–188
- Turner HA, Shattuck A, Finkelhor D, Hamby S (2015) Effects of poly-victimization on adolescent social support, self-concept, and psychological distress. *J Interpers Violence* 32(5):1–26
- Sündermann O, Onwumere J, Kane F, Morgan C, Kuipers E (2014) Social networks and support in first-episode psychosis: exploring the role of loneliness and anxiety. *Soc Psychiatry Psychiatr Epidemiol* 49(3):359–366
- Lim MH, Gleeson JFM, Alvarez-Jimenez M, Penn DL (2018) Loneliness in psychosis: a systematic review. *Soc Psychiatry Psychiatr Epidemiol* 53(3):221–238
- Rubin C, Rubenstein J, Stechler G, Heeren T, Halton A, Housman D, Kasten L (1992) Depressive affect in “normal” adolescents: relationship to life stress, family and friends. *Am J Orthopsychiatr Assoc* 62(3):430–441
- Landman-Peters KMC, Hartman CA, Van Der Pompe G, Den Boer JA, Minderaa RB, Ormel J (2005) Gender differences in the relation between social support, problems in parent-offspring communication, and depression and anxiety. *Soc Sci Med* 60(11):2549–2559
- Rueger SY, Malecki CK, Demaray MK (2010) Relationship between multiple sources of perceived social support and psychological and academic adjustment in early adolescence: comparisons across gender. *J Youth Adolesc* 39(1):47–61
- Quiroga A, López-Rodríguez L, Willis GB (2017) Parental support buffering the effect of violence on adolescents' depression: gender differences. *J Interpers Violence* 32(7):1068–1086
- Van Droogenbroeck F, Spruyt B, Keppens G (2018) Gender differences in mental health problems among adolescents and the role of social support: results from the Belgian health interview surveys 2008 and 2013. *BMC Psychiatry* 18(1):1–9
- Gayer-Anderson C, Fisher HL, Fearon P, Hutchinson G, Morgan K, Dazzan P, Boydell J, Doody GA, Jones PB, Murray RM, Craig TK, Morgan C (2015) Gender differences in the association between childhood physical and sexual abuse, social support and psychosis. *Soc Psychiatry Psychiatr Epidemiol* 50(10):1489–1500

20. Valtorta NK, Kanaan M, Gilbody S, Hanratty B (2016) Loneliness, social isolation and social relationships: what are we measuring? A novel framework for classifying and comparing tools. *BMJ Open* 6(4):1–7
21. Moffitt TE, The E-Risk Team (2002) Teen-aged mothers in contemporary Britain. *J Child Psychol Psychiatry* 43(6):727–742
22. Finkelhor D, Hamby SL, Turner H, Ormrod R (2011) The Juvenile Victimization Questionnaire: 2nd revision (JVQ-R2). Crimes Against Children Research Center, Durham
23. Fisher HL, Caspi A, Moffitt TE, Wertz J, Gray R, Newbury J, Ambler A, Zavos H, Danese A, Mill J, Odgers C, Pariante C, Wong CCY, Arseneault L (2015) Measuring adolescents' exposure to victimization: The Environmental Risk (E-Risk) Longitudinal Twin Study. *Dev Psychopathol* 27:1399–1416
24. Polanczyk G, Moffitt TE, Arseneault L, Cannon M, Ambler A, Keefe RSE, Houts R, Odgers CL, Caspi A (2010) Etiological and clinical features of childhood psychotic symptoms. *Arch Gen Psychiatry* 67(4):328–338
25. Loewy RL, Pearson R, Vinogradov S, Bearden CE, Cannon TD (2011) Psychosis risk screening with the Prodromal Questionnaire-brief version (PQ-B). *Schizophr Res* 129(1):42–46
26. Zimet G, Powell S, Farley G, Werkman S, Berkoff K (1988) Psychometric characteristics of the multidimensional scale of perceived social support. *J Personal Assess* 55(3):610–617
27. Trzesniewski KH, Moffitt TE, Caspi A, Taylor A, Maughan B (2006) Revisiting the association between reading achievement and antisocial behavior: new evidence of an environmental explanation from a twin study. *Child Dev* 77(1):72–88
28. Weissman MM (2000) Brief screening for family psychiatric history: the family history screen. *Arch Gen Psychiatry* 57(7):675–682
29. Milne BJ, Caspi A, Crump R, Poulton R, Rutter M, Sears MR, Moffitt TE (2008) How should we construct psychiatric family history scores? A comparison of alternative approaches from the Dunedin Family Health History Study. *Psychol Med* 38(12):1793–1802
30. Williams RL (2000) A note on robust variance estimation for cluster-correlated data. *Biometrics* 56(2):645–646
31. Krabbendam L, Janssen I, Bak M, Bijl RV, de Graaf R, van Os J (2002) Neuroticism and low self-esteem as risk factors for psychosis. *Soc Psychiatry Psychiatr Epidemiol* 37(1):1–6
32. Fisher HL, Schreier A, Zammit S, Maughan B, Munafo M, Lewis G, Wolke D (2013) Pathways between childhood victimization and psychosis-like symptoms in the ALSPAC birth cohort. *Schizophr Bull* 39(5):1045–1055
33. Eschenbeck H, Kohlmann C-W, Lohaus A (2007) Gender differences in coping strategies in children and adolescents. *J Individ Differ* 28(1):18–26
34. Rose AJ, Rudolph KD (2006) A review of sex differences in peer relationship processes: potential trade-offs for the emotional and behavioral development of boys and girls. *Psychol Bull* 132(1):98–131

### 5.2.1 Chapter 5 (Part 2): Supplementary Methods

#### *Study Cohort*

Participants were members of the Environmental Risk (E-Risk) Longitudinal Twin Study, which tracks the development of a nationally-representative birth cohort of 2232 British twin children. The sample was drawn from a larger cohort of twins born in England and Wales in 1994-1995.<sup>1</sup> Full details about the sample are reported elsewhere.<sup>2</sup> Briefly, the E-Risk sample was constructed in 1999-2000, when 1116 families with same-sex 5-year-old twins (93% of those eligible) participated in home-visit assessments. Families were recruited to represent the UK population of families with newborns in the 1990s, based on residential location throughout England and Wales and mothers' age. Teenaged mothers with twins were over-selected to replace high-risk families who were selectively lost to the register through non-response. Older mothers having twins via assisted reproduction were under-selected to avoid an excess of well-educated older mothers. E-Risk families are representative of UK households across the spectrum of neighborhood-level deprivation: 25.6% of E-Risk families live in "wealthy achiever" neighborhoods compared to 25.3% of households nation-wide; 5.3% vs 11.6% live in "urban prosperity" neighborhoods; 29.6% vs 26.9% live in "comfortably off" neighborhoods; 13.4% vs 13.9% live in "moderate means" neighborhoods; and 26.1% vs 20.7% live in "hard-pressed" neighborhoods.<sup>3,4</sup> E-Risk families under-represent "urban prosperity" neighborhoods because such households are likely to be childless. The sample comprised 56% monozygotic and 44% dizygotic twin pairs, and sex was evenly distributed within zygosity (49% male). All families were English speaking, and the majority (93.7%) were White.

Follow-up home visits were conducted when children were 7 years (98% of the 1116 E-Risk Study families participated), 10 years (96% participation), 12 years (96% participation) and 18 years (93% participation). Home visits at ages 5, 7, 10, and 12 years included assessments with participants as well as their mother (or primary caretaker); the home visit at age 18 included interviews only with the participants. Each twin participant was assessed by a different interviewer. The average age of the twins at the time of the age 18 assessment was 18.4 years ( $SD=0.36$ ); all interviews were conducted after the 18<sup>th</sup> birthday. There were no differences between those who did and did not take part at age 18 in terms of socioeconomic status (SES) assessed when the cohort was initially defined ( $\chi^2=0.86$ ,  $p=0.65$ ), age-5 IQ scores ( $t=0.98$ ,  $p=0.33$ ), or age-5 internalizing or externalizing behavior problems ( $t=0.40$ ,  $p=0.69$  and  $t=0.41$ ,  $p=0.68$ , respectively). The Joint South London and Maudsley and

the Institute of Psychiatry Research Ethics Committee approved each phase of the study. Parents gave informed consent, and participants gave assent at ages 5-12 and informed consent at age 18.

### ***Measure of adolescent psychotic experiences***

At age 18, each E-Risk participant was privately interviewed by a research worker about 13 psychotic experiences occurring since age 12. Seven items pertained to delusions and hallucinations, with items including “have other people read your thoughts?,” “have you thought you were being followed or spied on?,” and “have you heard voices that other people cannot hear?.” This interview has been described in detail previously,<sup>5</sup> and was used at age 12 to estimate childhood psychotic symptoms. The item choice was guided by the Dunedin Study’s age-11 interview protocol<sup>6</sup> and an instrument prepared for the Avon Longitudinal Study of Parents and Children.<sup>7</sup> Six items pertained to unusual experiences which drew on item pools since formalized in prodromal psychosis instruments including the PRIME-screen and SIPS.<sup>8</sup> These included “I worry that my food may be poisoned” and “My thinking is unusual or frightening”. Interviewers coded each item 0, 1, 2 indicating respectively “not present”, “probably present”, and “definitely present”. All 13 items were summed to create a psychotic experiences scale (range=0-18, M=1.19, SD=2.58). Just over 30% of participants had at least one psychotic experience between ages 12 and 18 (coded 1; n=623, 30.2%), while 69.8% reported no psychotic experiences (coded 0; n=1440). This is similar to the prevalence of self-reported psychotic experiences in other community samples of teenagers and young adults.<sup>9,10</sup>

### ***Measure of childhood mental health problems***

A variable for childhood mental health problems was derived to capture children who met criteria for extreme anxiety, clinically-relevant depression symptoms, attention deficit hyperactivity disorder (ADHD), or conduct disorder by age 12. Anxiety was assessed when children were aged 12, via private interviews using the 10-item version of the Multidimensional Anxiety Scale for Children (MASC).<sup>11</sup> An extreme anxiety group was formed with children who scored at or above the 95th percentile (n=129, 6.1%). Depression symptoms were assessed at age 12 using the Children’s Depression Inventory (CDI).<sup>12</sup> Children who scored 20 or more were deemed to have clinically significant depressive symptoms (n=74, 3.5%). ADHD was assessed using the DSM-IV and the requirement of symptom onset prior to age 12 was met if parents or teachers reported more than 2 ADHD

symptoms at ages 5, 7, 10, or 12 years. We derived diagnoses of conduct disorder on the basis of mothers' and teachers' reports of children's behaviour problems using the Achenbach family of instruments and additional DSM-IV items assessing conduct disorder which have previously been described.<sup>13</sup> Conduct disorder was assumed present if it was diagnosed at ages 5, 7, 10 or 12 years. This 'childhood mental health problems' variable was dichotomised to distinguish between the presence of any of the above mental health problems (coded 1) versus the absence of all of these age-12 mental health problems (coded as 0).

### **Assessment of victimization in adolescence**

We have previously reported evidence on the reliability and validity of our measurement of adolescent victimization.<sup>14</sup> Here we summarize the method. Participants were interviewed about experiences between 12-18 years using the Juvenile Victimization Questionnaire (JVQ),<sup>15,16</sup> adapted as a clinical interview. The JVQ has good psychometric properties<sup>17</sup> and was used in the U.K. National Society for the Prevention of Cruelty to Children national survey,<sup>18,19</sup> thereby providing benchmark values for comparisons with our cohort.

Within each pair of twins in our cohort, co-twins were interviewed separately by a different research worker and were assured of the confidentiality of their responses. The participants were advised that confidentiality would only be broken if they told the research worker that they were in immediate danger of being hurt, and in such situations the project leader would be informed and would contact the participant to discuss a plan for safety. We assessed 7 different forms of victimization: maltreatment, neglect, sexual victimization, family violence, peer/sibling victimization, internet/mobile phone victimization, and crime victimization. Each JVQ question was asked for the period 'since you were 12'. Participants were given the option to say "yes" or "no" as to whether each type of victimization had occurred in the reporting period. Research workers could rate each item "maybe" if the participant seemed unsure or hesitant in their response or they were not convinced that the participant understood the question or was paying attention. Items rated as "maybe" were recoded as "no" or "yes" by the rating team based on the notes provided by the research workers. When insufficient notes were available, these responses were recoded conservatively as a "no". Consistent with the JVQ manual,<sup>15,16</sup> participants were coded as 1 if they reported any experience within each type of victimization category, or 0 if none of the experiences within the category were endorsed. If an experience was endorsed within a victimization category, follow-up questions were asked concerning how old the participant

was when it (first) happened, whether the participant was physically injured in the event, whether the participant was upset or distressed by the event; and how long it went on for (by marking the number of years on a Life History Calendar.<sup>20</sup> In addition, the interviewer wrote detailed notes based on the participant's description of the worst event. If multiple experiences were endorsed within a victimization category, the participant was asked to identify and report about their worst experience.

All information from the JVQ interview was compiled into victimization dossiers. Using these dossiers, each of the seven victimization categories was rated by an expert in victimology and 3 other members of the E-Risk team who were trained on using the rating criteria. Ratings were made using a 6-point scale: 0 = not exposed, then 1-5 for increasing levels of severity. The anchor points for these ratings were adapted from the coding system used for the Childhood Experience of Care and Abuse interview (CECA),<sup>21,22</sup> which has good inter-rater reliability.<sup>21,23</sup> The CECA is a comprehensive semi-structured interview whose standardized coding system attempts to improve the objectivity of ratings by basing them on the coder's perspective (rather than relying on the participant's judgment) and focusing on concrete descriptions rather than perceptions or emotional responses to the questions, together with considering the context in which the adverse experience occurred.

In our adapted coding scheme, the anchor points of the scale differ for each victimization category, with some focused more on the severity of physical injury that is likely to have been incurred during victimization exposure (crime victimization, family violence, maltreatment), while others are more focused on the frequency of occurrence of victimization (peer/sibling victimization and internet/mobile phone victimization), the physical intrusiveness of the event (sexual victimization), or the pervasiveness of the effects of victimization (neglect). This reflects the different ways in which severity has previously been defined for different types of victimization.<sup>21,24</sup> (Given that our sample comprises twins, we also coded if any of the victimization events experienced by each twin had been perpetrated by their co-twin, as it is possible that growing up with a genetically related, same-age child could increase or decrease sibling victimization rates.) Each twin's dossier was evaluated separately, and we did not use information provided in the co-twin's dossier about their own or shared victimization experiences to rate direct or witnessed violence exposure for the target twin. High levels of inter-rater reliability were achieved for the severity ratings for all forms of victimization: crime victimization (intra-class correlation coefficient [ICC] = 0.89,  $p < 0.001$ ), peer/sibling victimization (ICC = 0.91,  $p < 0.001$ ), internet/mobile phone victimization (ICC = 0.90,  $p < 0.001$ ), sexual victimization (ICC = 0.87,



$p < 0.001$ ), family violence (ICC = 0.93,  $p < 0.001$ ), maltreatment (ICC = 0.90,  $p < 0.001$ ), and neglect (ICC = 0.74,  $p < 0.001$ ).

The ratings for each type of victimization were then grouped into three classes: 0 – no exposure (score of 0), 1 – some exposure (score of 1, 2 or 3), and 2 – severe exposure (score of 4 or 5) due to small numbers for some of the rating points. Combining ratings of 4 and 5 is also consistent with previous studies using the CECA, which have collapsed comparable scale values to indicate presence of ‘severe’ abuse.<sup>21,23,25,26</sup> The adolescent poly-victimization variable was derived by summing all victimization experiences that received a code of ‘4’ or ‘5’ (i.e., severe exposure): 64.6% of adolescents had zero severe victimization experiences; 19.2% had 1; 9.4% had 2; 4.5% had 3; 1.5% had 4; 0.5% had 5; and 0.2% had 6 severe victimization experiences. Due to small numbers in some of the groups, we collapsed this variable into ‘0’ not victimized, ‘1’ experienced 1 type of severe victimization, and ‘2’ poly-victimized (experienced 2 or more types of severe victimization).

## References

1. Trouton A, Spinath FM, Plomin R. Twins Early Development Study (TEDS): a multivariate, longitudinal genetic investigation of language, cognition and behavior problems in childhood. *Twin Res.* 2002;5(5):444-448.
2. Moffitt TE, E-Risk Study Team. Teen-aged mothers in contemporary Britain. *J Child Psychol Psychiatry.* 2002;43(5):1-16.
3. CACI. *ACORN user guide*. London, UK: CACI Information Services; 2006.
4. Caspi A, Taylor A, Moffitt TE, Plomin R. Neighborhood deprivation affects children's mental health: environmental risks identified in a genetic design. *Psychol Sci.* 2000;11(4):338-342.
5. Polanczyk G, Moffitt T, Arseneault L, et al. Etiological and clinical features of childhood psychotic symptoms. *Arch Gen Psychiatry.* 2010;67(4):328-338.
6. Poulton R, Caspi A, Moffitt TE, et al. Children's self-reported psychotic symptoms and adult schizophreniform disorder: a 15-year longitudinal study. *Arch Gen Psychiatry.* 2000;57:1053-1058.
7. Schreier A, Wolke D, Thomas K, et al. Prospective study of peer victimization in childhood and psychotic symptoms in a non-clinical population at age 12 years. *Arch Gen Psychiatry.* 2009;66:527-536.
8. Loewy RL, Pearson R, Vinogradov S, Bearden CE, Cannon TD. Psychosis risk screening with the Prodromal Questionnaire--brief version (PQ-B). *Schizophr Res.* 2011;129(1):42-6.
9. Kelleher I, Connor D, Clarke MC, Devlin N, Harley M, Cannon M. Prevalence of psychotic symptoms in childhood and adolescence: a systematic review and meta-analysis of population-based studies. *Psychol Med.* 2012;42:1857-1863.
10. Zammit S, Kounali D, Cannon M, et al. Psychotic experiences and psychotic disorders at age 18 in relation to psychotic experiences at age 12 in a longitudinal population-based cohort study. *Am J Psychiatry.* 2013;170:742-750.
11. March JS, Parker JD, Sullivan K, et al. The Multidimensional Anxiety Scale for Children (MASC): factor structure, reliability, and validity. *J Am Acad Child Adolesc Psychiatry.* 1997;36(4):554-565.
12. Kovacs M. *Children's Depression Inventory (CDI) manual*. Multi-Health Systems; 1992.
13. Kim-Cohen J, Moffitt TE, Caspi A, Taylor A. Genetic and environmental processes in young children's resilience and vulnerability to socioeconomic deprivation. *Child Dev.*

2004;75(3):651-668.

14. Fisher HL, Caspi A, Moffitt TE, et al. Measuring adolescents' exposure to victimization: The Environmental Risk (E-Risk) Longitudinal Twin Study. *Dev Psychopathol.* 2005;27(Special Issue 4):1399–1416.
15. Finkelhor D, Hamby SL, Turner HA, Ormrod RK. *The Juvenile Victimization Questionnaire: 2nd Revision (JVQ-R2)*. Durham, NH: Crimes Against Children Research Center; 2011.
16. Hamby S, Finkelhor D, Ormrod D, Turner H. *The comprehensive JVQ administration and scoring manual*. Durham, NH: University of New Hampshire, Crimes Against Children Research Center; 2004.
17. Finkelhor D, Hamby SL, Ormrod RK, Turner HA. The Juvenile Victimization Questionnaire: reliability, validity, and national norms. *Child Abuse Negl.* 2005;29:383-412.
18. Radford L, Corral S, Bradley C, Fisher H, Bassett C, Howat N, Collishaw S. *Child abuse and neglect in the UK today*. London: NSPCC; 2011.
19. Radford L, Corral S, Bradley C, Fisher HL. The prevalence and impact of child maltreatment and other types of victimization in the UK: findings from a population survey of caregivers, children and young people and young adults. *Child Abuse Negl.* 2013;37(10):801-813.
20. Caspi A, Moffitt TE, Thornton A, et al. The life history calendar: A research and clinical assessment method for collecting retrospective event-history data. *Int J Methods Psychiatr Res.* 1996;6:101-114.
21. Bifulco A, Brown GW, Harris TO. Childhood Experience of Care and Abuse (CECA): a retrospective interview measure. *J Child Psychol Psychiatry.* 1994;35(8):1419-1435.
22. Bifulco A, Brown GW, Neubauer A, Moran P, Harris T. *Childhood Experience of Care and Abuse (CECA) training manual*. London: Royal Holloway College, University of London; 1994.
23. Bifulco A, Brown GW, Lillie A, Jarvis J. Memories of childhood neglect and abuse: Corroboration in a series of sisters. *J Child Psychol Psychiatry.* 1997;38:365-374.
24. Barnett D, Manly JT, Cicchetti D. Defining child maltreatment: The interface between policy and research. In D Cicchetti & SL Toth (Eds.), *Child abuse, child development, and social policy* (pp. 7-74). Norwood, NJ: Ablex; 1993.
25. Bifulco A, Brown GW, Moran P, Ball C, Campbell C. Predicting depression in women: the role of past and present vulnerability. *Psychol Med.* 1998;28:39–50.

26. Fisher HL, Bunn A, Jacobs C, Moran P, Bifulco A. Concordance between mother and offspring retrospective reports of childhood adversity. *Child Abuse Negl.* 2011;35(2):117–122.

## **Chapter 6: Using discordant twin methods to investigate an environmentally mediated pathway between social support and the reduced likelihood of adolescent psychotic experiences**

This study is not yet published and is therefore provided in chapter format. The aim of this study is to utilise discordant twin methods in order to consider whether social support has a unique environmentally mediated effect on adolescent psychotic experiences after accounting for familial factors, including genetic factors, and also prior psychopathology.

## Introduction

It is widely acknowledged that psychotic experiences such as hearing voices and feeling very paranoid, occur amongst individuals in the general population (McGrath et al., 2015). They are relatively common, with prevalence rates around 17% during childhood and 8% during adolescence (Kelleher et al., 2012a). Poly-victimisation (exposure to two or more types of victimisation) has been found to be a major risk factor for the emergence of psychotic phenomena with the odds of reporting such phenomena around five times higher than the general population (Arseneault et al., 2011; Crush et al., 2018a; Crush et al., 2018b). A large proportion of children and adolescents in the general population will not develop psychotic phenomena, even in the context of poly-victimisation (Arseneault et al., 2011; Janssen et al., 2004; Shevlin, Houston, Dorahy, & Adamson, 2008). Therefore, research focused on those who do not develop psychotic phenomena, despite being at high risk (poly-victimised), may provide valuable insights into which factors reduce the likelihood of psychotic experiences emerging and thus inform preventive interventions. Preventing early psychotic phenomena is crucial not only because these experiences are extremely distressing for adolescents (Kelleher et al., 2015) but also because they have been shown to predict suicidal behaviours (Kelleher et al., 2012b) and major psychiatric disorders (Fisher et al., 2013) in later life.

In a recent paper (see Chapter 5), we found social support particularly from friends and family to be protective in relation to age-18 psychotic experiences in the general population and amongst a high-risk group of poly-victimised adolescents after controlling for gender, family socioeconomic status, family psychiatric history, and childhood mental health problems including psychotic symptoms (Crush et al, 2018b). We concluded that these findings provide evidence for an independent protective effect of adolescent social support in relation to psychotic phenomena in a nationally-representative longitudinal cohort study. This chapter aims to further interrogate the potentially causal nature of this association by taking advantage of our longitudinal twin sample to control for all unmeasured shared family-wide environmental and genetic factors that could be confounding this association, and also accounting for earlier mental health problems to rule out the possibility of reverse causality.

A causal association would be inferred if social support was found to have a direct, environmentally-mediated protective effect on adolescent psychotic phenomena. Ultimately, evidence for this would indicate that interventions to increase social support, or perceptions of social support, could be effective in preventing the development of psychotic

phenomena in adolescence. In order to investigate this, other alternative explanations need to be ruled out, including potential confounding by shared family-wide environmental and genetic factors, and also considering whether reverse causality is operating, all of which are considered herein and discussed below.

There are several non-causal or indirect explanations for why higher levels of social support are associated with a reduced likelihood of developing psychotic experiences during adolescence. Firstly, environments or experiences shared by family members, including the home and community environment could influence perceptions of social support and also protect against the onset of psychotic phenomena. For example, children who grow up in a warm, nurturing home environment are less likely to report psychotic phenomena (Crush et al., 2018a) and may also perceive others to be more supportive, perhaps due to secure attachment formation (Blain, Thompson, & Whiffen, 1993). Similarly, individuals who grow up in a neighbourhood with high social cohesion may have more access to social support within their community, while low neighbourhood social cohesion has been found to be associated with the emergence of psychotic phenomena (Newbury et al., 2016). Therefore, shared family-wide environmental factors might be confounding the protective effect of social support on psychotic experiences.

Secondly, genetic factors may also explain the association by influencing both perceptions of social support and the propensity to develop psychotic experiences. Indeed, there are modest to high heritability estimates for the emergence of psychotic phenomena during childhood and adolescence (Polanczyk et al., 2010; Zavos et al., 2014). Additionally, despite intuitively social support being considered an environmental exposure, it is also influenced by genetic factors (Kendler, 1997), with a moderate heritability of 40% found in the current cohort (Matthews et al., 2016). Given that social support and psychotic phenomena are both influenced by genetic factors, it is possible that genes may confound the association between them. For example, it is plausible that individuals with paranoia or suspicious thoughts, that may arise from a genetic predisposition towards psychotic experiences, could have problems maintaining relationships with friends (Claes, 1994) and family (Riggio and Kwong, 2011), and be less appealing to new potential friends or partners. Conversely, those without such genetic vulnerability may be more likely to elicit social support and also be protected from developing psychotic phenomena.

Relatedly, the potential for reverse causality should be considered in the association between social support and psychotic phenomena. It is possible that early manifestations of psychosis or other mental health problems in childhood might reduce affected individuals'

social networks, and the resulting social isolation may increase the likelihood of psychotic phenomena developing or persisting. Indeed, individuals with early signs of psychosis have been shown to have limited social networks (Gayer-Anderson and Morgan, 2013), and psychotic symptoms and other mental health problems in childhood have also been shown to increase risk for adolescent psychotic phenomena (Polanczyk et al., 2010; Zammit et al., 2013). Those without mental health problems in childhood might therefore be more likely to have greater social support and less likely to develop psychotic phenomena in adolescence. Therefore, it is important to take into account prior psychopathology to improve understanding of the temporal association between social support and adolescent psychotic phenomena.

This study aims to utilise the discordant twin design (Pingault et al., 2018; Vitaro, Brendgen, & Arseneault, 2009) in a longitudinal cohort to consider the relative family-wide versus unique environmental effects of social support on adolescent psychotic experiences and control for earlier psychopathology. This approach capitalises on the fact that twins reared together share the same family environment and the same genes (100% for monozygotic [MZ] twins; 50% for dizygotic twins). To estimate family-wide effects of social support we will firstly consider between-twin effects, thus testing whether twin pairs with higher social support also have a reduced likelihood of psychotic phenomena relative to other twin pairs with lower levels of social support. Next to estimate the unique environmental effects of social support we will consider the within-twin effects, i.e. whether twins with higher levels of social support than their co-twin also have a reduced likelihood of adolescent psychotic phenomena relative to their co-twin. Modelling these effects together allows us to ascertain the unique environmental effects of social support on psychotic phenomena relative to shared family-wide effects. We will additionally conduct analyses restricted to MZ twins to fully rule out genetic confounding, and also control for psychotic symptoms and other mental health problems in childhood to rule out reverse causality. Analyses will be run in the full general population sample and also in the sub-group of adolescents who have been poly-victimised to test whether a unique environmental pathway is still evident in this high-risk group.



## **Methods**

### **Study Cohort**

Participants were members of the Environmental Risk (E-Risk) Longitudinal Twin Study, which tracks the development of a nationally-representative birth cohort of 2232 British twin children born in England and Wales in 1994-1995. See Methods section of this thesis for further details on the study cohort.

## **Measures**

### ***Adolescent Psychotic Experiences***

The present study uses a self-report measure of adolescent psychotic experiences. At age 18, each E-Risk participant was privately interviewed by a trained research worker about 13 psychotic experiences occurring since age 12 and the responses were summed. Full details are provided in the Methods section of this thesis.

### ***Social Support***

Social support was assessed using the 12-item Multidimensional Scale of Perceived Social Support (MSPSS), which assesses individuals' access to supportive relationships with family, friends and significant others (Zimet, Powell, Farley, Werkman, & Berkoff, 1988). Full details are provided in the Methods section of this thesis.

### ***Adolescent Poly-Victimisation***

At age 18, participants were interviewed about exposure to a range of adverse experiences between 12-18 years using the Juvenile Victimization Questionnaire, 2nd revision (JVQ-R2) (Finkelhor, Hamby, Turner, & Ormrod, 2011) adapted as a clinical interview. Full details are provided in the Methods section of this thesis.

### ***Potential Confounders***

Family socioeconomic status (SES), childhood psychotic symptoms and other childhood mental health problems (including extreme anxiety, clinically-relevant depression symptoms, attention deficit hyperactivity disorder (ADHD), or conduct disorder) were all controlled for in the relevant analyses. Further information on each of these measures is provided in the Methods section of this thesis.

## Statistical Methods

We applied Generalised Estimating Equations (GEE) with binominal function specified (logistic regression) and an exchangeable correlation structure to account for familial clustering in order to simultaneously estimate the family-wide (between-twin pair) and unique (within-twin pair) effects of social support on age-18 psychotic experiences (Carlin, Gurrin, Sterne, Morley, & Dwyer, 2005; Vitaro, Brendgen, & Arseneault, 2009). The between-twin pair analysis considers whether pairs of twins with higher social support than other twin pairs are also less likely to have psychotic experiences. In contrast, the within twin-pair analysis considers whether the twin with higher social support than his or her co-twin is also less likely to have psychotic experiences than his or her co-twin (Carlin et al., 2005). Because co-twins share their rearing environment as well as half (dizygotic twins) or all (monozygotic twins) their genes, significant within-twin pair effects would indicate that social support is associated with a reduced likelihood of psychotic experiences independent of latent, family-wide factors, thus suggesting a unique environmental effect of social support. Further restricting analyses to MZ twins fully rules out genetic influences, and additionally controlling for age-12 psychotic symptoms and other childhood mental health problems accounts for the possibility of reverse causality. All analyses were conducted in the full general population sample and also in the sub-group of poly-victimised adolescents where both twins were poly-victimised (n=158).

## Results

We have previously shown that social support was associated with a reduced likelihood of age-18 psychotic experiences amongst adolescents in the whole sample (OR=0.91, 95% CI: 0.89-0.93,  $p<0.001$ ) and amongst a high-risk group exposed to poly-victimisation (OR=0.93; 95% CI: 0.88-0.98,  $p=0.009$ ) after controlling for gender, family SES, age-12 psychotic symptoms and other mental health problems at age 12 (Crush et al., 2018b).

### ***Is the association between increased social support and a reduced likelihood of psychotic experiences during adolescence accounted for by shared environmental and genetic factors?***

Using discordant twin analyses in the whole sample, we considered the association between overall social support, and each sub-type of social support, with a reduced likelihood of adolescent psychotic experiences at age 18. We found that these associations were explained by family-wide effects of social support shared by twin pairs, therefore showing

that twin pairs with higher social support were less likely to report psychotic experiences relative to twin pairs who reported lower social support. Notably, we also found evidence of a unique environmental effect, whereby higher perceived social support by one twin relative to their co-twin was associated with a reduced likelihood of psychotic experiences (Table 1). When analyses were repeated for MZ twins only (to fully control for genetic influences), we again found both family-wide influences and the unique environment to be implicated in the associations for total social support and for support from both family and friends (Table 1), although the findings were inconclusive in relation to social support from significant others. The fact the results showed a significant within-twin-pair association for total social support, and also social support from friends and family, with a reduced likelihood of psychotic experiences in both the whole sample and MZ group provides support for the presence of a unique environmentally-mediated protective pathway for these social support types.

Similarly, amongst twins exposed to poly-victimisation, we found evidence of a unique environmental effect of total social support and support from friends on a reduced likelihood of adolescent psychotic experiences (Table 1). When analyses were restricted to MZ twins only who had both been exposed to poly-victimisation, we found similar trends (Table 1). However, these effects were not significant, possibly due to the relatively small number of twins (N=96) within this sub-group.

**Table 1. Family-wide and unique environmental effects of social support on age-18 psychotic experiences**

<b>Social Support Scale</b>	<b>Whole Sample</b>		<b>Both Twins Poly-Victimised</b>	
	All Twins N=2059	MZ Twins N=1162	All Twins N=158	MZ Twins N=96
	Adjusted OR* (95% CI)	Adjusted OR* (95% CI)	Adjusted OR* (95% CI)	Adjusted OR* (95% CI)
<b>Total</b>				
Family-wide	<b>0.89 (0.86-0.92)</b>	<b>0.91 (0.88-0.95)</b>	0.94 (0.84-1.04)	0.98 (0.85-1.11)
Unique	<b>0.93 (0.90-0.96)</b>	<b>0.93 (0.89-0.97)</b>	<b>0.91 (0.82-1.00)</b>	0.92 (0.81-1.04)
<b>Family</b>				
Family-wide	<b>0.75 (0.70-0.80)</b>	<b>0.77 (0.70-0.84)</b>	0.85 (0.70-1.02)	0.84 (0.66-1.06)
Unique	<b>0.85 (0.78-0.92)</b>	<b>0.86 (0.77-0.96)</b>	0.81 (0.61-1.08)	0.80 (0.61-1.05)
<b>Friends</b>				
Family-wide	<b>0.78 (0.73-0.84)</b>	<b>0.82 (0.76-0.90)</b>	0.90 (0.73-1.10)	1.03 (0.80-1.33)
Unique	<b>0.88 (0.82-0.94)</b>	<b>0.88 (0.80-0.96)</b>	<b>0.81 (0.69-0.96)</b>	0.85 (0.69-1.04)
<b>Significant Others</b>				
Family-wide	<b>0.90 (0.84-0.97)</b>	0.97 (0.89-1.07)	1.01 (0.79-1.30)	1.15 (0.87-1.51)
Unique	<b>0.92 (0.86-0.99)</b>	0.92 (0.84-1.02)	0.92 (0.68-1.24)	1.00 (0.62-1.63)

\*Adjusted for child's gender. CI, confidence interval. MZ, monozygotic. OR, odds ratio. Bold text indicates p<0.05. Family-wide indicates between-twin pair difference; unique, within-twin pair difference.

***Is the association between increased social support and a reduced likelihood of psychotic experiences accounted for by childhood psychopathology?***

Next, in order to rule out any potential reverse causality between social support and psychotic experiences, we controlled for psychotic symptoms and other mental health problems at age 12 to support the interpretation of the directionality of the association. We found that the unique environmental effect of total social support on the reduced likelihood of adolescent psychotic experiences remained significant when accounting for earlier psychopathology within the full sample and when analyses were restricted to MZ twins only to fully account for genetic influences (Table 2), thus ruling out reverse causality. The buffering effects of support from friends and family were also robust to adjustment for prior childhood psychopathology and shared family environmental and genetic factors (Table 2).

A similar pattern of results was found after controlling for earlier mental health problems in the poly-victimised group, with total social support and support from friends continuing to have a significant unique environmental effect on the reduced likelihood of adolescent psychotic experiences (Table 2). When restricting analyses to MZ twins, only non-significant trends were found (Table 2) but again this was probably due to the small number in this high-risk sub-group (N=96).

**Table 2. Family-wide and unique environmental effects of social support on age-18 psychotic experiences controlling for childhood mental health problems**

<b>Social Support Scale</b>	<b>Whole Sample</b>		<b>Both Twins Poly-Victimised</b>	
	All Twins N=2059	MZ Twins N=1162	All Twins N=158	MZ Twins N=96
	Adjusted OR* (95% CI)	Adjusted OR* (95% CI)	Adjusted OR* (95% CI)	Adjusted OR* (95% CI)
<b>Total</b>				
Family-wide	<b>0.90 (0.87-0.93)</b>	<b>0.92 (0.88-0.96)</b>	0.93 (0.83-1.04)	0.97 (0.83-1.13)
Unique	<b>0.93 (0.90-0.96)</b>	<b>0.92 (0.88-0.97)</b>	<b>0.90 (0.82-1.00)</b>	0.91 (0.80-1.04)
<b>Family</b>				
Family-wide	<b>0.77 (0.72-0.83)</b>	<b>0.79 (0.72-0.87)</b>	0.83 (0.68-1.01)	0.80 (0.63-1.03)
Unique	<b>0.86 (0.79-0.93)</b>	<b>0.86 (0.76-0.97)</b>	0.85 (0.64-1.13)	0.81 (0.60-1.08)
<b>Friends</b>				
Family-wide	<b>0.80 (0.75-0.85)</b>	<b>0.84 (0.77-0.91)</b>	0.91 (0.74-1.11)	1.08 (0.84-1.39)
Unique	<b>0.87 (0.81-0.93)</b>	<b>0.86 (0.78-0.96)</b>	<b>0.78 (0.66-0.92)</b>	0.82 (0.65-1.03)
<b>Significant Others</b>				
Family-wide	<b>0.91 (0.85-0.98)</b>	0.97 (0.88-1.07)	0.99 (0.74-1.32)	1.13 (0.79-1.64)
Unique	<b>0.92 (0.85-0.99)</b>	0.91 (0.82-1.01)	0.89 (0.65-1.20)	1.00 (0.59-1.67)

\*Adjusted for child's gender, age-12 psychotic symptoms, and other mental health problems at age 12. CI, confidence interval. MZ, monozygotic. OR, odds ratio. Bold text indicates  $p < 0.05$ . Family-wide indicates between-twin pair difference; unique, within-twin pair difference.

## Discussion

This is the first study to consider whether social support has an environmentally-mediated effect on psychotic phenomena amongst adolescents in the general population and amongst those at high risk by virtue of having been exposed to poly-victimisation. Our findings indicate a unique environmental effect of higher perceived social support on psychotic phenomena amongst our general population sample. These effects were apparent in relation to overall social support and also separately for social support from friends and family. These results held after accounting for shared family-wide environmental and genetic influences as well as for earlier psychopathology thus ruling out these potentially confounding effects and reverse causality explanations. We also found evidence for a direct environmentally mediated protective effect of perceived social support on adolescent psychotic experiences even within the high-risk poly-victimised group. Collectively, these findings provide evidence for a possible causal association between higher perceived social support and the reduced likelihood of adolescent psychotic experiences and therefore add weight to the importance of social support as a potential candidate for preventive interventions focused upon adolescent psychotic phenomena.

Overall our findings have practical implications as they suggest that early prevention efforts focusing upon improving perceived social support – through greater availability of supportive figures or enhancing perceptions of existing social support, could be effective in protecting against the development of psychotic phenomena in adolescence. Interventions aimed at improving social support from family and peers have previously been found to be effective amongst individuals who already have psychosis (Castelein et al., 2008; Norman et al., 2005; Pilling et al., 2002). Whilst family interventions have been most widely applied, recently there has been increased support for the use of peer interventions (Harrop, Ellett, Brand, & Lobban, 2015; Morin, Dhir, Mitchell, & Jones, 2017) which our findings also indicate might be helpful. Given resources for interventions are limited, it is possible that internet-based peer support networks could represent a promising solution (Álvarez-Jiménez et al., 2012; Naslund, Aschbrenner, Marsch, & Bartels, 2016), as well as specifically targeting adolescents at high risk due to exposure to multiple forms of victimisation.

There are several mechanisms through which social support may exert protective influences in relation to psychotic experiences in both the general population and also amongst those at high risk of developing psychotic phenomena due to poly-victimisation exposure. For instance, it is possible that social support may facilitate stress reduction (Cohen and Wills, 1985), improve self-esteem (Dumont & Provost 1999; Turner, Shattuck,

Finkelhor & Hamby, 2015), and may also reduce feelings of loneliness (Sündermann, Onwumere, Bebbington, & Kuipers, 2014), which have all been implicated in the development of psychotic phenomena (Corcoran et al., 2003; Lim, Gleeson, Alvarez-Jimenez, & Penn, 2018; Pruessner, Iyer, Faridi, Joobar, & Malla, 2011; Smith et al., 2006).

### **Limitations**

Some limitations warrant consideration. Firstly, both social support and psychotic experiences were measured at age 18 which has implications for interpreting the directionality of the association between them. We did, however, control for a broad range of earlier mental health problems at age 12, including age-12 psychotic symptoms, to account for this as far as possible and are thus able to largely rule out reverse causality. Research around the consistency of social support during adolescence has not suggested any fundamental shifts in total social support levels over time, whilst there are trends for family support being replaced by peer support, relatively stable levels of support appear to be maintained (Cantin and Boivin, 2004; Levitt, Guacci-Franco and Levitt, 1993). Relatedly, as the social support scale used is a subjective measure reflecting individuals' perceptions of support from friends, family and significant others, it is possible that adolescents who develop psychotic experiences perceive their social support levels to be lower than they actually are and therefore we welcome replication of our findings amongst cohorts with co-informant measures of social support. Additionally, due to the number of poly-victimised adolescents being relatively low (N=334), our ability to detect some associations may have been affected by this. These analyses thus warrant replication in even larger twin cohorts. Finally, our measure of psychotic experiences was a self-report measure and it is possible that it captured some genuine experiences (e.g., being followed by someone), as well as psychotic phenomena (e.g. being followed by a fictional character). Nonetheless, we have previously shown that higher levels of social support were associated with a reduced likelihood of clinically-verified adolescent psychotic symptoms (Crush et al., 2018b), indicating that this is unlikely to have substantially affected our findings. We were unable to run the current analyses with clinically-verified psychotic symptoms as the outcome due to the small number of individuals with these symptoms in our cohort (n=59).



## **Conclusion**

The association between greater perceived social support and a reduced likelihood of psychotic experiences in adolescence appears to be extremely robust, even in the context of poly-victimisation, as it was not fully accounted for by family-wide environmental or genetic factors nor was there any evidence of reverse causation. These findings suggest that early intervention programmes focused on increasing perceptions of social support, particularly from friends, have the potential to prevent the emergence of psychotic experiences amongst adolescents. Given that there are finite resources for interventions, efforts might be most efficiently targeted at adolescents exposed to multiple forms of victimisation who are at high risk of developing psychotic phenomena.

## **Chapter 7: Discussion**

This thesis examined the developmental interplay between individual, family, and community-level protective factors, psychotic phenomena and poly-victimisation. The main aims were to 1) test whether multi-level protective factors were found to be associated with a reduced likelihood of psychotic symptoms amongst children exposed to poly-victimisation; 2) understand whether multi-level factors were found to be protective amongst adolescents exposed to poly-victimisation; 3) explore gender differences in relation to the protective effects of social support amongst adolescents exposed to poly-victimisation; and 4) understand the extent to which the association between social support and a reduced likelihood of adolescent psychotic experiences in this sample was environmentally mediated. This chapter provides a summary of the key findings within the empirical chapters as well as a discussion of the methodological considerations, implications, and future directions of the findings from the current thesis.

### **7.1 Summary of findings from empirical chapters**

**7.1.1 Are individual, family, and community-level factors associated with a reduced likelihood of psychotic symptoms among children exposed to multiple forms of victimisation?**

Children exposed to multiple forms of victimisation were approximately five times more likely to report psychotic symptoms at age 12. Having a relatively higher IQ and growing up in a more positive home environment were associated with a reduced likelihood of psychotic symptoms emerging during childhood, with a strong trend also found in relation to neighbourhood social cohesion, suggesting these factors are protective factors in relation to early psychotic phenomena. All associations held after controlling for a range of potential confounders including family socio-economic status, family psychiatric history and child's gender. When considering whether these factors were particularly protective in the context of poly-victimisation, this was not found to be the case, as indicated by the finding that all three factors were found to be associated with a reduced likelihood of psychotic symptoms in the whole sample regardless of poly-victimisation exposure. These findings indicate the presence of protective factors across multiple levels in relation to psychotic phenomena

during childhood in the context of poly-victimisation and also among the general population, thus supporting each of the three hypotheses (1.1-1.3) outlined in Chapter 1.

7.1.2 Are individual, family, and community-level factors associated with a reduced likelihood of psychotic phenomena among adolescents in the general population and among individuals exposed to multiple forms of victimisation?

Exposure to multiple forms of victimisation during adolescence was associated with increased odds of psychotic experiences emerging by age 18 by almost five times. The study found engaging in physical activity, higher levels of neighbourhood social cohesion, and increased social support were associated with a reduced likelihood of psychotic experiences being reported in the general population regardless of victimisation exposure. Again, these associations were not explained by various potential confounders including family socio-economic status, family psychiatric history, child's gender, age-12 psychotic symptoms, and other mental health problems at age 12. Broadly similar results were also found when analyses were repeated in the group of adolescents with clinically-verified psychotic symptoms. Next, this study demonstrated that increased social support remained protective in relation to psychotic experiences among adolescents exposed to poly-victimisation during adolescence, and a strong trend also emerged for engaging in physical activity. Therefore, the four hypotheses (2.1-2.4) outlined in Chapter 1 were supported by these findings.

7.1.3 Are there gender differences in relation to the protective effects of social support in relation to psychotic phenomena among poly-victimised adolescents?

Gender differences were identified whereby social support was only found to be protective in relation to psychotic experiences for girls exposed to poly-victimisation, but not boys. Specifically, perceptions of overall social support and support from friends and family were found to be protective for girls, but the associations for total social support and each sub-type of social support were not found to be significant for boys (though there was a non-significant trend for family support to be protective for boys). These findings largely support the corresponding hypothesis (3.1) stated in Chapter 1.

#### 7.1.4. To what extent is the association between social support and psychotic phenomena environmentally mediated?

Perceived social support, particularly from friends and also family, was found to have a unique environmentally mediated effect on the reduced likelihood of psychotic experiences in the whole sample and in the high-risk poly-victimised group. Findings also indicated an effect for family-wide influences, including shared environmental and genetic factors, but these did not fully account for the association. The study largely ruled out reverse causality, meaning that earlier psychopathology did not account for the association between social support and psychotic phenomena in either the full sample or the poly-victimised group. These findings support the relevant hypotheses (4.1-4.4) that were postulated in Chapter 1.

## 7.2 Discussion of main findings

### 7.2.1 Poly-victimisation and early psychotic phenomena during childhood and adolescence

Psychotic phenomena were found to be significantly more common among individuals exposed to multiple forms of victimisation versus no or one type of victimisation during childhood and adolescence, and this association was stronger relative to exposure to single forms of victimisation. These findings are indicative of a dose-response relationship between different types of victimisation and psychotic phenomena which is consistent with other studies which have previously found that exposure to multiple forms of victimisation increased the risk for psychotic phenomena emerging beyond individual victimisation exposures (Janssen et al., 2004; Kelleher et al., 2013; Shevlin, Houston, Dorahy, & Adamson, 2008). Interestingly, a range of different types of victimisation were captured during both childhood and adolescence, therefore a variety of different combinations of victimisation types were experienced by poly-victimised individuals, suggesting that it is cumulative exposure to severe victimisation broadly that was associated with psychotic phenomena as opposed to specific types of victimisation driving the association.

### 7.2.2 Multi-level protective factors for psychotic symptoms during childhood

In terms of the key factors to emerge as being protective, having a relatively high IQ and a more positive atmosphere at home were independently associated with a reduced likelihood of childhood psychotic symptoms, even in the context of exposure to poly-victimisation.

These findings show parallels with the broader resilience literature which has consistently highlighted a role for cognitive ability and a positive home environment in adaptive mental health outcomes and functioning amongst individuals exposed to adversity (Afifi & MacMillan, 2011; Collishaw et al., 2007; Meng, Fleury, Xiang, Li, & D'Arcy, 2018; Rutter, 1987). Furthermore, a strong trend emerged for social cohesion being protective in the context of poly-victimisation which is consistent with studies which have found more positive community environments to be associated with better mental health outcomes (DuMont, Widom, & Czaja, 2007; Dumont & Provost, 1999). The same three factors (IQ, atmosphere at home, and neighbourhood social cohesion) were also associated with a reduced likelihood of psychotic phenomena in the general population, indicating that these factors were not specifically protective in the context of poly-victimisation but rather seemed to be broadly protective against the development of early psychotic phenomena. This finding contradicts broader theories which suggest that there are "special" or "unique" factors that specifically protect individuals in the context of risk (Brumley & Jaffee, 2016; Rutter, 1985). In the absence of specific literature related to psychosis in this area it is difficult to know whether the research in this thesis challenges these theoretical implications, but it will be important for this to be broadly considered in the future. That is whether it the same factors that protect in the context of adversity compared to factors that are associated with an absence of psychotic phenomena in the general population.

### 7.2.3 Multi-level protective factors for psychotic phenomena during adolescence

Adolescents in the general population were less likely to report psychotic phenomena when they reported higher levels of social support, engaged in physical activity, or resided in neighbourhoods with higher levels of social cohesion. These findings are consistent with a number of other studies which have reported that social support (Gayer-Anderson et al., 2015; Sündermann, Onwumere, Kane, Morgan, & Kuipers, 2014), physical activity (Sormunen et al., 2017; Suetani et al., 2017), and social cohesion (Binbay et al., 2012; Newbury et al., 2016) are associated with a reduced likelihood of psychotic phenomena in the general population. In the high-risk group exposed to poly-victimisation, higher levels of social support were found to be protective in relation to psychotic phenomena, with a strong trend also found for engaging in physical activity. These findings are consistent with another cohort study which reported that declines in earlier social and communication skills preceded the emergence of psychotic experiences in adolescence (Hameed et al., 2018). When considering the social support sub-scales, social support from friends and family were both

independently associated with a reduced likelihood of adolescent psychotic experiences in the poly-victimised group. These findings are consistent with the broader literature which has previously reported that social support from friends and family can buffer the effects of victimisation exposure in relation to a range of mental health problems emerging during adolescence (Smyth, Siriwardhana, Hotopf, & Hatch, 2015; Yeung & Leadbeater, 2010). The nature of these findings have the potential to inform intervention efforts on a broad population level and also amongst poly-victimised adolescents.

#### 7.2.4 Gender differences, social support & adolescent psychotic phenomena

Perceived social support, particularly from friends but also from family, was found to be protective in relation to psychotic experiences amongst poly-victimised adolescent girls, but not boys. Amongst adolescent boys there was a strong trend for support from family to be protective, but this association did not meet conventional levels of statistical significance. These findings are interesting as they are consistent with a body of literature which has previously identified that social support is more strongly associated with an absence of psychopathology and better psychological adjustment amongst adolescent girls (Landman-Peeters et al., 2005; Quiroga, López-Rodríguez, & Willis, 2017; Rubin et al., 1992; Rueger, Malecki, & Demaray, 2010). In terms of key mechanisms to explain these findings, social support has previously been found to improve self-esteem, particularly amongst adolescent girls (Bolognini, Plancherel, Bettschart, & Halfon, 1996). Furthermore, low self-esteem has been found to be predictive of psychotic phenomena in non-clinical populations (Krabbendam et al., 2002) and has also been shown to mediate associations between victimisation and adolescent psychotic experiences (Fisher et al., 2013b). Therefore, it is plausible that self-esteem could be a key pathway through which social support from friends and family reduces the likelihood of psychotic experiences amongst adolescent girls exposed to poly-victimisation. Further exploration of the role of family social support for boys using larger samples is warranted.

#### 7.2.5 Environmentally mediated influences of social support in relation to adolescent psychotic phenomena

The association between social support from friends, family and significant others, and a reduced likelihood of psychotic experiences in adolescence was explained by both family-wide factors (shared by both twins) and also the unique environmental influences in the general population. Furthermore, in the poly-victimised group there was evidence of unique

environmental influences of total social support and support from friends on a reduced likelihood of psychotic phenomena. When controlling for earlier mental health problems including psychotic symptoms during childhood in both the whole sample and in the poly-victimised subgroup, the unique environmental effects of social support remained significant, which provides evidence for ruling out reverse causality. This suggests that social support was protective in relation to psychotic phenomena, as opposed to psychotic phenomena or other forms of earlier psychopathology resulting in lower levels of social support in adolescence whilst also predicting later psychotic phenomena emerging.

Collectively, these findings suggest that the protective effects of social support on adolescent psychotic experiences are robust and cannot be accounted for by shared environmental or genetic factors nor earlier psychopathology. In terms of mechanisms through which social support may be exerting protective effects in relation to psychotic phenomena, it is possible that social support may buffer the effects of stress through how individuals appraise stressful events and also facilitate adaptive responses (Cohen & Wills, 1985). For example, social support may bolster an individual's perceptions of their ability to cope with adversity and may also influence the severity of the physiological stress response, whereby the availability of social support subsequent to stressful events may act as an informal intervention which buffers against stress (Cohen & Wills, 1985). Other research has suggested that social support may improve self-esteem (Dumont & Provost 1999; Turner et al. 2015), and reduce feelings of loneliness (Sündermann, Onwumere, Kane, Morgan, & Kuipers, 2014), which have also been implicated in the development of psychotic phenomena (Corcoran et al., 2003; Lim, Gleeson, Alvarez-Jimenez, & Penn, 2018; Pruessner, Iyer, Faridi, Joobar, & Malla, 2018; Smith et al., 2006). These findings add weight to the potential effectiveness of increasing perceptions of social support in the context of interventions aiming to reduce the likelihood of psychotic experiences developing amongst adolescents, given this association is - to some meaningful extent - environmentally mediated.

### **7.3 Limitations and methodological considerations**

#### **7.3.1 Cross-sectional analyses during adolescence**

Chapters 5 and 6 utilise cross-sectional analyses to consider the associations between physical activity and social support with adolescent psychotic experiences which were all reported on when participants were aged 18. Unfortunately, earlier measures of physical

activity and social support were not available during mid-adolescence and therefore it is difficult to disentangle the direction of the association between these factors and psychotic experiences. It is possible that the presence of psychotic phenomena during mid-adolescence could result in individuals isolating themselves from social support or being less physically active which our findings cannot rule out. That said, prior research has suggested there is consistency in levels of social support received by individuals during adolescence, whereby there does not appear to be any fundamental shifts in total social support levels during this developmental period, whilst family support does appear to be replaced by peer support, overall relatively stable levels of support appear to be maintained (Cantin & Boivin 2004; Levitt et al. 1993). Physical activity levels have been found to consistently decline over the school years from age 6 to age 16 (Sallis, 1993), suggesting age 18 is a time where levels are lower than their peak for the majority of individuals. It would therefore be interesting to consider the extent to which physical activity is protective in relation to psychotic phenomena during the earlier developmental phase of childhood in a sample with earlier measures of physical activity. Where possible, the studies in the current thesis aim to provide clarity regarding the directionality of the associations between variables by controlling for earlier factors, for example, Chapters 5 and 6 both control for age-12 psychotic symptoms and a wide range of mental health problems at age 12 in order to provide support for the directionality of the associations being as interpreted. Nonetheless, it will be important for future studies to replicate these associations in longitudinal cohorts which benefit from earlier measures of predictors in order to more robustly rule out reverse causality.

### 7.3.2 Social support was a subjective measure

Social support is a complex concept and has previously been assessed through a variety of methods and approaches (Gayer-Anderson & Morgan, 2013). One key distinction is between subjective (e.g., feelings towards social relationships) versus objective measures (e.g., number of social interactions) of social support, furthermore there is often a distinction between structural social support which is quantitatively focused (e.g., size of social networks) versus functional support which are qualitative measures (e.g., availability of adequate social support) (Valtorta, Kanaan, Gilbody, & Hanratty, 2016). The social support scale used in the current thesis was a subjective measure reflecting individuals' perceptions of support from friends, family and significant others and thus captures both the perceived availability and also functional aspects of social support. Furthermore, social support was considered amongst those who did and did not develop psychotic phenomena, therefore it



is possible that the social support scores could have been biased in the group of individuals who reported psychotic phenomena. Specifically, adolescents who develop psychotic experiences may perceive their support levels to be lower than the support that is actually available. It is acknowledged that using one subjective measure to consider the protective effects of social support potentially underestimates the complexity and multi-dimensional nature of social support and therefore replication of these findings considering different measures, specifically co-informant measures, would be helpful to understand this association more clearly.

### 7.3.3 Specificity of protective factors for psychotic phenomena

The focus of this thesis was in relation to psychotic phenomena although a range of mental health problems can emerge further to poly-victimisation exposure, including suicide, depression, and anxiety (Dube et al., 2001; Edwards, Holden, Felitti, & Anda, 2003). The first empirical chapter briefly considered this when investigating protective factors during childhood (Chapter 4), by exploring the prevalence of other mental health problems in the poly-victimised group who did not develop psychotic phenomena. This group reported high levels of other mental health problems in childhood compared to the general population, suggesting that the protective factors identified showed specificity to psychotic phenomena in the context of poly-victimisation. Therefore, when considering protective factors in adolescence (Chapters 5 & 6), earlier mental health problems were instead controlled for to provide evidence for directionality of the associations but broader mental health problems during adolescence were not considered as outcomes. The primary reason for this is it was considered beyond the scope of the key aims of this thesis to consider multi-level protective factors for a wide range of mental health outcomes, and given there was specificity found in childhood this highlighted how broadening the scope of research to explore all potential protective factors for all potential mental health problems would have been too substantial for one thesis. Incidentally, this restricts the findings of the current thesis to psychotic phenomena during childhood and adolescence and the extent to which the findings are applicable therefore to the broader mental health literature is inconclusive at this early stage of research.

### 7.3.4 Timing and prevalence of poly-victimisation exposures

Despite this being a large data-rich cohort, the number of poly-victimised children (N=140) and adolescents (N=334) was modest and this may have limited our ability to detect some

associations between protective factors and a reduced likelihood of developing psychotic phenomena, and particularly interaction effects. These analyses thus warrant replication in even larger cohorts of adolescents. It was also not possible to account for the specific timing of different victimisation types during either childhood or adolescence; it is possible that the proximity of different victimisation exposures for example could have had an effect on outcomes, but unfortunately this information was not available in the E-Risk cohort to consider.

#### 7.3.5 Psychotic experiences in adolescence were not clinically-verified

Whilst obtained during private face-to-face interviews, the adolescent psychotic experiences measure used in Chapters 5 and 6 was a self-report measure where responses were not verified by a team of clinicians as per the childhood measure. Just under a third of adolescents reported having psychotic experiences between age 12 and 18 which is at the upper end of that typically reported in the literature for adolescence and these rates vary substantially depending on the assessment method used. For example, in a meta-analysis of population-based studies that had used either previously validated items (Kelleher, Harley, Murtagh, & Cannon, 2011) or clinically-verified interviews, Kelleher et al. (2012a) reported a 7.5% prevalence of psychotic symptoms during adolescence. In contrast, endorsement of self-report screening items among adolescents has been reported to be higher ranging from around 10% (have you ever heard voices talking to each other when you were alone?) to 90% (have you ever felt as if some people are not what they seem to be?) depending on item (Yung et al., 2009). It is therefore possible that the adolescent psychotic experiences measure in this thesis captured some genuine experiences (e.g., a real incident of being followed by a stranger). That said, the main focus of both studies was on the group who did not develop psychotic phenomena and therefore false positives are less problematic. Furthermore, sensitivity analysis revealed comparable results for the association with protective factors and adolescent psychotic symptoms (which were verified by clinicians and experts). Nonetheless, the findings in this thesis would benefit from replication in a larger sample using a clinically-verified measure of adolescent psychotic phenomena.

#### 7.3.6 Sub-clinical psychotic phenomena are not psychotic disorders

As eluded to in Chapter 1, sub-clinical psychotic phenomena do not constitute the presence or eventual presence of psychotic disorders and therefore it is important to emphasise that the current findings in relation to poly-victimisation and also specific protective factors might

not generalise to adult psychotic disorders. Relatedly, the psychotic phenomena measures in this thesis included only positive symptoms without considering any negative or cognitive symptoms which would also form part of psychotic disorder diagnoses (ICD-11; World Health Organization, 2018). This suggests that the findings in relation to protective factors within the empirical chapters may only be relevant in relation to positive symptoms and general population samples. Early psychotic phenomena are also known to predict a range of other serious adult psychiatric problems, including depression, post-traumatic stress disorder, substance abuse and suicidal behaviour (Fisher et al., 2013b; Kelleher et al., 2012b; Poulton et al., 2000), and the current thesis did not consider how protective factors may influence these longer-term outcomes. Collectively, these points highlight how the present findings, particularly in relation to identification of specific protective factors, are specific to psychotic phenomena during childhood and adolescence in the general population and are not directly generalisable to psychosis or other mental health problems during later adulthood.

#### 7.3.7 General population versus poly-victimised groups

Findings from the empirical chapters suggest that factors which were protective in the context of poly-victimisation did not differ from the factors generally associated with a reduced likelihood of psychotic phenomena in the general population. Furthermore, the analyses were conducted within the poly-victimised sub-group, as opposed to controlling for poly-victimisation, suggesting that these results are not merely capturing the main effect in the general population sample. There would need to be a substantial difference between the extent to which factors are associated with a reduced likelihood of psychotic phenomena in the poly-victimised group, compared to the general population, for interactions to be detected. Historically the literature in relation to both resilience and protective factors has suggested that there are unique factors which are especially protective in the context of risk (Bowes et al., 2009; Brumley & Jaffee, 2016; Rutter, 1987), however, our findings do not support this is the case in relation to poly-victimisation and psychotic phenomena. Unfortunately, there are no comparable studies to consider our findings in relation to and therefore it will be interesting to see whether future studies are able to identify specific factors which are especially relevant or specific to a high-risk group, relative to the general population in the context of psychotic phenomena.

### 7.3.8 Potential protective factors not available in the E-Risk cohort

It is possible that other factors could be protective in relation to psychotic phenomena which were not available in the E-Risk cohort. For example, a recent systematic review by Meng et al. (2018) considered protective factors for a broad range of mental health outcomes further to childhood maltreatment; the review highlighted a wide range of protective factors including all the factors already included in the current thesis as well as: attachment, locus of control, self-esteem and self-efficacy. The E-Risk cohort does not have specific measures for these aforementioned variables and it is possible therefore that these, amongst other factors, could also be protective in relation to psychotic phenomena among poly-victimised children or adolescents, but unfortunately it was not possible to explore this in the current thesis. Relatedly, whilst a number of factors were considered consistently across childhood and adolescence in the empirical chapters including IQ, atmosphere at home and social cohesion, some of the variables available during adolescence were not available in the earlier phases. For example, a physical activity measure was not available in the E-Risk cohort during childhood and therefore it is not possible to know whether this factor was also protective during this earlier developmental period, or if it is specifically protective amongst poly-victimised adolescents. Moreover, it is possible that different factors might be operating in adulthood and be culturally or generationally specific. Therefore, replication of the factors found to be protective for psychotic phenomena in the current thesis is required across different age ranges, time periods, and cultures.

### 7.3.9 A sample of twins, not singletons

A key concern when using twin data is that twin siblings could differ from singletons in relation to exposures and outcomes, which could have implications for the generalisability of the findings. In terms of the outcome measures used in the empirical chapters, the prevalence of psychotic phenomena during childhood and adolescence was consistent with that reported in similar aged non-twin samples (Kelleher et al., 2012a; Spauwen, Krabbendam, Lieb, Wittchen, & van Os, 2006; Yoshizumi, Murase, Honjo, Kaneko, & Murakami, 2004; Yung et al., 2009). Another potential issue when considering twins in the context of victimisation relates to the fact that being a twin could reduce or increase the likelihood of exposure, for example, the conspicuousness of identical twins could increase their risk of being victimised by peers and strangers. However, the prevalence of victimisation exposures does not appear to materially differ in this cohort; childhood

exposure to poly-victimisation in the E-Risk cohort was 6.6%, which is comparable to a prior study done by the National Society for the Prevention of Cruelty to Children (NSPCC); where poly-victimisation was evident among 8.9% of children across the UK (Radford, Corral, Bradley, & Fisher, 2013). Similarly, the prevalence of victimisation during adolescence within the E-Risk cohort was slightly higher than during childhood at 16.2%, but again prevalence rates for each type of victimisation during adolescence were similar to findings reported by the NSPCC (see Fisher et al., 2015). It is also possible that protective factors might operate differently within twin samples compared to singleton samples. For instance, twins naturally have a same-aged sibling who may be a source of social support and thus they might be more protected than singletons without siblings. Nonetheless, as mentioned above, rates of psychotic phenomena are similar in this twin sample to other contemporary singleton samples suggesting that twins were not more protected from developing these phenomena than singletons. However, further investigation and replication of these protective factors in singleton samples is warranted to ensure broader generalisability of the findings.

#### 7.3.10 The majority of twins in the E-Risk cohort are White

The majority of individuals in the E-Risk cohort are of White ethnicity (93.7%) which was comparable to the proportion of White individuals in England and Wales in the early 1990s at 94.1%. It is noted that the proportion of White individuals has marginally fallen within England and Wales since the early 1990s, with the latest estimate to be 86.0% (Office for National Statistics, 2011). Therefore, it is possible that this could limit the extent to which the findings are applicable in contemporary times to ethnic minority groups and also to individuals outside of the UK. Relatedly, replication of the findings in this thesis would be useful amongst cohorts which have a higher percentage of ethnic minority groups to understand the extent to which protective factors for psychotic phenomena are common across different ethnicity groups and cultural contexts.

### 7.4 Implications

The implications of the findings from the current thesis are outlined below although it is noted that given the lack of literature in this area, these implications are subject to replication of the key findings in other large population-based cohorts. There are two overarching implications from the empirical chapters, firstly the findings provide support for the need for early interventions in relation to psychotic phenomena during childhood and

adolescence and relatedly provide guidance for specific areas which would be useful for interventions to focus upon. Secondly, given resources are finite for mental health interventions, the findings suggest that prevention efforts would be most cost-effectively targeted at the smaller “higher risk” group of poly-victimised children or adolescents, given that they are at substantially higher risk of developing psychotic phenomena than their non-victimised peers. This is important to recognise given resources for mental health interventions are often severely limited. The key implications from each empirical chapter will now be discussed.

Chapter 4 considered childhood psychotic phenomena and firstly identified that a higher IQ was protective in the context of poly-victimisation. Firstly, it is possible that IQ scores could be used to identify children at higher risk for developing psychotic phenomena in order to target interventions and secondly, general cognitive ability could represent a relevant area for interventions to focus upon. It is acknowledged that IQ constitutes a difficult trait to target through interventions, although it is possible that having a higher IQ facilitated adaptive outcomes indirectly, for example through the development of effective coping styles such as problem solving or help seeking, which have been found to bolster resiliency against mental health problems (Bonanno, 2004; Dumont & Provost, 1999). In order to better understand how the findings regarding IQ can be effectively applied in the context of interventions, it would be interesting for future studies to investigate how IQ differences between children changes the way they either perceive or react to stress. Relatedly, cognitive behavioural therapies are being developed for children that aim to target and develop skills such as reasoning and emotional coping, as a way of increasing resilience (Ames et al., 2014). Cognitive remediation therapy is another approach that may offer a way to alleviate cognitive difficulties in young people (Wykes et al., 2007).

There is also the possibility that a higher IQ is in fact indicative of neurodevelopmental impairments which have been associated with psychosis (Bohlken, Brouwer, Mandl, Kahn, & Hulshoff Pol, 2016; Cannon et al., 2002), which would suggest IQ is primarily helpful for identifying those at higher risk for psychotic phenomena emerging. These findings are also interesting given that atmosphere at home was found to be protective, and it is possible that the home environment is critical for cognitive ability at this early stage, particularly given that IQ is known be substantially influenced by the environment during childhood (Bouchard, 2013; Hoekstra, Bartels, & Boomsma, 2007). That said, atmosphere at home and IQ were independently associated with a reduced likelihood of psychotic symptoms, suggesting that IQ requires attention in its own right. To summarise,

there is potential for the utility of IQ in the context of interventions, however further research is needed to understand the direct and indirect pathways through which IQ and a reduced likelihood of psychotic phenomena are associated before it is more clearly apparent how interventions targeting IQ can be employed.

A positive atmosphere at home was found to be protective in relation to childhood psychotic phenomena and this naturally lends itself towards being a potentially useful focus for intervention efforts. The atmosphere at home measure had various sub-scales which are also useful to consider in the context of interventions; in the high-risk poly-victimised group only the physical state of the home was found to be independently protective, whilst stimulation, happiness within the home and also the extent to which the home environment was predictable and calm, showed strong trends. These findings are consistent with findings that living in chaotic situations can increase risk for early psychotic symptoms (Winsper, Wolke, Bryson, Thompson, & Singh, 2016). Whether victimisation takes place inside or outside the home, it is possible that a positive, safe, calm environment can provide a refuge for children which may lessen the adverse effects of their victimisation experiences (Repetti, Taylor, & Seeman, 2002). Relatedly, it could be important for interventions to focus upon educating parents regarding the home environment, from both a physical and emotional perspective. It would be useful for future studies (perhaps through in-depth qualitative interviews or longitudinal home observations) to investigate further which specific elements are protective in order to inform prevention strategies.

The key implication from the findings presented in Chapters 5 and 6 is that interventions focused upon improving perceived social support – through greater availability of supportive figures or increasing individuals' perceptions of their existing social support, might be effective in protecting against the development of psychotic phenomena in adolescence. Indeed, it has previously been found that interventions aimed at improving social support from family and peers can be effective amongst individuals with psychosis (Castelein et al. 2008; Norman et al. 2005; Pilling et al. 2002). Social skills training has also been found to improve positive and negative symptoms among patients with psychosis (Lecomte, Leclerc, & Corbie, 2008). Given declines in social and communication skills have been shown to precede the development of psychotic experiences in early adolescence (Hameed et al., 2018), this potentially represents an interesting area worth further consideration in adolescent at-risk populations, such as those exposed to poly-victimisation. The existing literature suggests that family interventions have been most widely used in the context of improving outcomes for individuals with psychosis, though recently there has

been an increased focus on the use of peer interventions (Harrop, Ellett, Brand, & Lobban, 2015; Morin, Dhir, Mitchell, & Jones, 2017) which the findings from the empirical chapters also support. Given resources for interventions are limited, it is possible that internet-based peer support networks could represent a promising solution (Álvarez-Jiménez et al., 2012; Naslund, Aschbrenner, Marsch, & Bartels, 2016).

Physical activity also showed a strong protective trend in the poly-victimised group. There has been a recent surge in research considering the beneficial effects of physical activity and exercise as interventions for individuals with psychosis (Firth, Cotter, Elliott, French, & Yung, 2015; Stubbs et al., 2016). Research into the effectiveness of exercise in preventing the emergence of psychotic phenomena is in the early stages although the current findings do support this as an area which warrants further attention in the context of poly-victimisation. It is encouraging that increasing the availability of social support and improving physical activity levels constitute interventions that would be feasible to implement on both the population level and amongst high-risk groups.

## **7.5 Future directions**

There are a range of potential future directions that could extend upon the research presented in this thesis; below an overview of potential avenues is provided.

### **7.5.1 Further interrogation of the relationships between protective factors and psychotic phenomena**

Firstly, it will be interesting to see whether future studies find similar multi-level factors to be protective in relation to psychotic phenomena amongst children and adolescents exposed to poly-victimisation. The present studies set out to identify key factors found to be associated with a reduced likelihood of psychotic phenomena emerging but were only able to skim the surface in terms of exploring the broader relationship between individual protective factors with psychotic phenomena. In order to build on the foundation of the results herein, it would be interesting for further analyses to consider the nature of the relationships between protective factors and psychotic phenomena. For instance, trichotomisation analyses have been used to distinguish risk and protective factors (Herrenkohl, Lee, & Hawkins, 2012) and also to identify specific levels or ranges that are most likely to be protective. Trichotomisation is an approach where linear predictor variables are divided into three groups representing low, medium and high levels, which allows each level



to be independently considered with the outcome variable and also for differences between levels to be considered. For example, this approach would allow for average levels of social support to be compared with low levels in relation to being associated with an absence of psychotic phenomena, and also for average levels to be compared to high levels, and so on. Trichotomisation would be a useful next step to utilise to better understand protective factors that have been well-established in the literature whereby findings have been replicated. Additionally, statistical methods have been used which involve testing for non-linear relationships between putative protective factors and outcomes to understand relationships in more detail (Horwood et al., 2008). It would also be useful to conduct research to interrogate the mechanisms underlying the relationship between individual protective factors with psychotic phenomena. Such findings would be extremely useful to inform the content of preventive interventions.

#### 7.5.2 Consideration of the mechanisms underlying the association between protective factors and psychotic phenomena

It would be interesting for future research to explore the mechanisms through which factors exert protective influences in relation to psychotic phenomena amongst children and adolescents, in order to further inform intervention and prevention efforts. This thesis was only able to hypothesise what the key mechanisms may be, including self-esteem improvements and stress reduction, but was not able to specifically consider these factors directly. Subject to the original associations being replicated, it would be interesting for future research to explore the mechanisms, which may or may not be common across different factors, in order to underpin the creation of any treatment or interventions targeting psychotic phenomena.

#### 7.5.3 Same factors protective for other high-risk groups

The studies within the current thesis exclusively considered poly-victimisation as a risk factor although there are other risk exposures factors which may increase the likelihood of psychotic phenomena emerging. Relatedly, the E-Risk cohort recently found that all the protective factors identified in the current thesis (IQ, atmosphere at home, physical activity, social support and social cohesion) were also protective in relation to psychotic phenomena amongst children and adolescents of mothers with psychosis (Riches et al., 2018). Therefore, it would be interesting to see whether the various protective factors identified in the current thesis are also protective in the context of other risk exposures, such as living in an urban

environment (Newbury et al., 2016). Another approach could be to explore protective factors in a cohort where individuals are “at-risk” of psychosis such the London Child Health and Development Study (CHADS) where children were selected for having a triad of risk factors for schizophrenia. It would be useful to consider whether protective factors are able to predict those who do versus do not go on to develop psychotic phenomena at a sub-clinical and clinical level. Related to the above point (7.5.2), understanding the mechanisms through which different protective factors exert buffering effects on mental health may also facilitate understanding parallels across risk exposures, for example if protective factors help individuals to improve coping mechanisms, perhaps there will be consistency of protective factors in relation to a range of different risk exposures.

#### 7.5.4 Other mental health outcomes

Given that poly-victimisation is associated with a range of adverse mental health problems, it would make practical sense for protective factors to be considered systematically in relation to each of the outcomes known to be associated with poly-victimisation including depression, anxiety and suicide (Dube et al., 2001; Edwards, Holden, Felitti, & Anda, 2003). Considering protective factors in this context would initially require theoretical consideration of multi-level factors you might expect to be associated with different mental health outcome individually, and also factors which may be protective with mental health outcomes more broadly. Whilst it would be a significant undertaking to identify differences and similarities across mental health outcomes for poly-victimised individuals, the implications of this could be extremely valuable. In terms of practical implications, identification of common protective factors could allow interventions to have broader reach or alternatively highlight the need for a more individualised or disorder-specific approach to improving mental health outcomes in the context of poly-victimisation.

#### 7.5.5 Considering protective factors for psychotic phenomena outcomes during adulthood

This thesis was only able to consider the development of psychotic phenomena up to age-18 and therefore it is not known whether the individuals who do not develop psychotic phenomena either in the general population or in the context of poly-victimisation are protected beyond adolescence. It would be interesting for other longitudinal cohort which have data on the protective factors identified in the current thesis and also psychotic phenomena outcomes during adulthood, to consider whether factors are protective in the longer term, both in the general population and amongst high risk poly-victimised groups.

## **7.6 Conclusions**

This thesis provides evidence for individual, family, and wider community factors being protective in relation to psychotic phenomena in the context of poly-victimisation during both childhood and adolescence. The empirical studies have been able to identify a number of potential protective candidates which could inform prevention efforts and early interventions targeting psychotic phenomena. The potential for research into protective factors for psychotic phenomena is vast and exciting, these phenomena represent some of the most extreme, complex experiences that exist within the context of mental health and taking different approaches to preventing their development and persistence deserves ongoing research attention. Relatedly, the task of understanding what could protect individuals against psychotic phenomena, and indeed the use of the word “protective”, should not be underestimated, and therefore replication, interrogation and expansion of these findings is needed. Collectively, the findings from this thesis constitute a unique contribution to the existing literature on poly-victimisation and psychotic phenomena and can hopefully guide future research into this important area of child and adolescent mental health.

## References

- Aas, M., Djurovic, S., Athanasiu, L., Steen, N. E., Agartz, I., Lorentzen, S., . . . , Melle, I. (2012). Serotonin transporter gene polymorphism, childhood trauma, and cognition in patients with psychotic disorders. *Schizophrenia Bulletin*, 38(1), 15–22.
- Achenbach, T. (1991). *Manual for the child behavior checklist and 1991 profile*. Burlington, VT: University of Vermont Department of Psychiatry.
- Abi-Dargham, A. (2004). Do we still believe in the dopamine hypothesis? New data bring new evidence. *The International Journal of Neuropsychopharmacology*, 7(5), S1–S5.
- Afifi, T.O., & MacMillan, H.L. (2011). Resilience following child maltreatment: A review of protective factors. *Canadian Journal of Psychiatry*, 56(5), 266–272.
- Ajnakina, O., Trotta, A., Oakley-Hannibal, E., Di Forti, M., Stilo, S. A., Kolliakou, A., . . . , Fisher, H.L. (2016). Impact of childhood adversities on specific symptom dimensions in first-episode psychosis. *Psychological Medicine*, 46(2), 317–326.
- Aleman, S., Arias, B., Aguilera, M., Villa, H., Moya, J., Ibáñez, M. I., . . . , Fañanás, L. (2011). Childhood abuse, the BDNF-Val66Met polymorphism and adult psychotic-like experiences. *The British Journal of Psychiatry*, 199(1), 38–42.
- Álvarez-Jiménez, M., Gleeson, J.F., Bendall, S., Lederman, R., Wadley, G., Killackey, E., & McGorry, P.D. (2012). Internet-based interventions for psychosis. A sneak-peek into the future. *Psychiatric Clinics of North America*, 35(3), 735–747.
- Ames, C.S., Jolley, S., Laurens, K.R., Maddox, L., Corrigall, R., Browning, S., . . . , Kuipers, E. (2014). Modelling psychosocial influences on the distress and impairment caused by psychotic-like experiences in children and adolescents. *European Child & Adolescent Psychiatry*, 23, 715–722.
- Anilmis, J., Stewart, C.S, Roddy, S., Hassanali, N., Muccio, F., Browning, S., . . . , Jolley, S. (2015). Understanding the relationship between schematic beliefs, bullying, and unusual experiences in 8 – 14 year olds. *European Psychiatry*, 30(8), 920–923.
- Appiah-Kusi, E., Fisher, H.L., Petros, N., Wilson, R., Mondelli, V., Garety, P.A., McGuire, P., & Bhattacharyya, S. (2017). Do cognitive schema mediate the association between childhood trauma and being at ultra-high risk for psychosis? *Journal of Psychiatric Research*, 88, 89–96.

- Appleyard, K., Egeland, B., van Dulmen, M.H.M., & Sroufe, L.A. (2005). When more is not better: The role of cumulative risk in child behavior outcomes. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, 46(3), 235–245.
- Arseneault, L., Bowes, L., & Shakoor, S. (2010). Bullying victimization in youths and mental health problems: “much ado about nothing”? *Psychological Medicine*, 40(5), 717–729.
- Arseneault, L., Cannon, M., Fisher, H.L., Polanczyk, G., Moffitt, T.E., & Caspi, A. (2011). Childhood trauma and children’s emerging psychotic symptoms: A genetically sensitive longitudinal cohort study. *American Journal of Psychiatry*, 168, 65–72.
- Arseneault, A., Walsh, E., Trzesniewski, K., Newcombe, R., Caspi, A., & Moffitt, T.E. (2006). Bullying victimization uniquely contributes to adjustment problems in young children: a nationally representative cohort study. *Pediatrics*, 118, 130-138.
- Baddeley, A. (1996). Exploring the central executive. *Quarterly Journal of Experimental Psychology*, 49, 5–28.
- Barahmand, U., & Heydari Sheikh Ahmad, R. (2016). Psychotic-like experiences and psychological distress: The role of resilience. *Journal of the American Psychiatric Nurses Association*, 22(4), 312–319.
- Barnett, D., Manly, J.T., Cicchetti, D. (1993). *Defining child maltreatment: The interface between policy and research*. Norwood, NJ: Ablex.
- Belsky, J., & Pluess, M. (2009). Beyond diathesis stress: Differential susceptibility to environmental influences. *Psychological Bulletin*, 135(6), 885–908.
- Bennett, N., Jarvis, L., Rowlands, O., Singleton, N., & Haselden, L. (1996). *Living in Britain: Results from the 1994 general household survey*. London: HMSO.
- Bentall, R.P., & Fernyhough, C. (2008). Social predictors of psychotic experiences: Specificity and psychological mechanisms. *Schizophrenia Bulletin*, 34(6), 1012–1020.
- Bentall, R.P., Rowse, G., Shryane, N., Kinderman, P., Howard, R., Blackwood, N., . . . , Corcoran, R. (2009). The cognitive and affective structure of paranoid delusions. *Archives of General Psychiatry*, 66(3), 236-247.
- Berton, O., Mcclung, C.A., Dileone, R.J., Krishnan, V., Renthal, W., Russo, S. J., . . . , Nestler, E.J. (2006). Essential role of BDNF in the in the mesolimbic pathway in social defeat stress. *Science*, 311, 864–868.

- Bifulco, A., Bernazzani, O., Moran, P.M., & Jacobs, C. (2005). The Childhood Experience of Care and Abuse Questionnaire (CECA.Q): Validation in a community series. *British Journal of Clinical Psychology*, 44(4), 563–581.
- Bifulco, A., Brown, G.W., Lillie, A., & Jarvis, J. (1997). Memories of childhood neglect and abuse: Corroboration in a series of sisters. *Journal of Child Psychology and Psychiatry*, 38, 365–374.
- Bifulco, A., Brown, G.W., Moran, P., Ball, C., & Campbell, C. Predicting depression in women: the role of past and present vulnerability. *Psychological Medicine*, 28, 39–50.
- Bifulco, A., Brown, G.W., Neubauer, A., Moran, P., & Harris, T. (1994). *Childhood Experience of Care and Abuse (CECA) training manual*. London: Royal Holloway College, University of London.
- Binbay, T., Drukker, M., Alptekin, K., Elbi, H., Aksu Tanık, F., Özkınay, F., . . . , van Os, J. (2012). Evidence that the wider social environment moderates the association between familial liability and psychosis spectrum outcome. *Psychological Medicine*, 42(12), 2499–2510.
- Blain, M.D., Thompson, J.M., & Whiffen, V.E. (1993). Attachment and perceived social support in late adolescence. *Journal of Adolescent Research*, 8, 226–241.
- Bohlken, M.M., Brouwer, R.M., Mandl, R.C. W., Kahn, R.S., & Hulshoff Pol, H.E. (2016). Genetic variation in schizophrenia liability is shared with intellectual ability and brain structure. *Schizophrenia Bulletin*, 42(5), 1167–1175.
- Bolognini, M., Plancherel, B., Bettschart, W., & Halfon, O. (1996). Self-esteem and mental health in early adolescence: development and gender differences. *Journal of Adolescence*, (19), 233–245.
- Bonanno, G.A. (2004). Loss, trauma, and human resilience: have we underestimated the human capacity to thrive after extremely aversive events? *The American Psychologist*, 59(1), 20–28.
- Bouchard, T.J. (2013). The Wilson Effect: the increase in heritability of IQ with age. *Twin Research and Human Genetics: The Official Journal of the International Society for Twin Studies*, 16(5), 923–930.
- Bowes, L., Arseneault, L., Maughan, B., Taylor, A., Caspi, A., & Moffitt, T.E. (2009). School, neighborhood, and family factors are associated with children’s bullying involvement: a

nationally representative longitudinal study. *Journal of the American Academy of Child and Adolescent Psychiatry*, 48(5), 545–553.

Bowes, L., Maughan, B., Ball, H., Shakoor, S., Ouellet-Morin, I., Caspi, A., . . . , Arseneault, L. (2013). Chronic bullying victimization across school transitions: the role of genetic and environmental influences. *Development and Psychopathology*, 25(2), 333–346.

Bowes, L., Maughan, B., Caspi, A., Moffitt, T.E., & Arseneault, L. (2010). Families promote emotional and behavioural resilience to bullying: evidence of an environmental effect. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, 51(7), 809–817.

Boyette, L-L., van Dam, D., Meijer, C., Velthorst, E., Cahn, W., de Haan, L., . . . , Myin-Germeys, I. (2014). Personality compensates for impaired quality of life and social functioning in patients with psychotic disorders who experienced traumatic events. *Schizophrenia Bulletin*, 40(6), 1356–1365.

Bradley, R., & Caldwell, B. (1977). Home observation for measurement of the environment: a validation study of screening efficiency. *American Journal of Mental Deficiency*, 81, 417–420.

Brett, C., Heriot-Maitland, C., McGuire, P., & Peters, E. (2014). Predictors of distress associated with psychotic-like anomalous experiences in clinical and non-clinical populations. *British Journal of Clinical Psychology*, 53, 213–227.

Brumley, L.D., & Jaffee, S.R. (2016). Defining and distinguishing promotive and protective effects for childhood externalizing psychopathology: a systematic review. *Social Psychiatry and Psychiatric Epidemiology*, 51(6), 803–815.

Bucci, S., Emsley, R., & Berry, K. (2017). Attachment in psychosis: A latent profile analysis of attachment styles and association with symptoms in a large psychosis cohort. *Psychiatry Research*, 247, 243–249.

CACI Information Services (2006). ACORN user guide. London, UK: CACI.

Callaghan, P. (2004). Exercise: a neglected intervention in mental health care? *Journal of Psychiatric and Mental Health Nursing*, 11(4), 476–483.

Campbell-Sills, L., Cohan, S.L., Stein, M.B. (2006). Relationship of resilience to personality, coping, and psychiatric symptoms in young adults. *Behaviour Research and Therapy*, 44(4), 585–599.

- Cannon, M., Caspi, A., Moffitt, T.E., Harrington, H., Taylor, A., Murray, R.M., & Poulton, R. (2002). Evidence for early-childhood, pan-developmental impairment specific to schizophreniform disorder. *Archives of General Psychiatry*, 59, 449–456.
- Cantin, S., & Boivin, M. (2004). Change and stability in children's social network and self-perceptions during transition from elementary to junior high school. *International Journal of Behavioral Development*, 28, 561–570.
- Cardno, A.G., & Gottesman, I.I. (2000). Twin studies of schizophrenia: from bow-and-arrow concordances to star wars mx and functional genomics. *American Journal of Medical Genetics*, 97(1), 12–17.
- Carlin, J.B., Gurrin, L.C., Sterne, J.A.C., Morley, R., & Dwyer, T. (2005). Regression models for twin studies: A critical review. *International Journal of Epidemiology*, 34, 1089–1099.
- Carver, C.S., Scheier, M.F., & Weintraub, J.K. (1989). Assessing coping strategies: A theoretically based approach. *Journal of Personality and Social Psychology*, 56(2), 267–283.
- Caspi, A., Henry, B., McGee, R.O., Moffitt, T.E., & Silva, P.A. (1995). Temperamental origins of child and adolescent behavior problems: from age three to age fifteen. *Child Development*, 66, 55–68.
- Caspi, A., Moffitt, T.E., Thornton, A., Freedman, D., Amell, J.W., Harrington, H., . . . , Silva, P.S. (1996). The life history calendar: A research and clinical assessment method for collecting retrospective event-history data. *International Journal of Methods in Psychiatric Research*, 6(2), 101-114.
- Caspi, A., Taylor, A., Moffitt, T.E., & Plomin, R. (2000). Neighborhood deprivation affects children's mental health: environmental risks identified in a genetic design. *Psychological Science*, 11(4), 338-342.
- Castelein, S., Bruggeman, R., van Busschbach, J.T., van der Gaag, M., Stant, A.D., Knegtering, H., & Wiersma, D. (2008). The effectiveness of peer support groups in psychosis: A randomized controlled trial. *Acta Psychiatrica Scandinavica*, 118(1), 64–72.
- Office for National Statistics (2011). Ethnicity and National Identity in England and Wales: 2011. Retrieved from:  
<https://www.ons.gov.uk/peoplepopulationandcommunity/culturalidentity/ethnicity/articles/ethnicityandnationalidentityinenglandandwales/2012-12-11>



- Chang, W.C., Sau, C., Wong, M., Yu, E., Chen, H., Chiu, L., . . . , Bebbington, P. (2018). Lifetime prevalence and correlates of schizophrenia-spectrum, affective, and other non-affective psychotic disorders in the Chinese adult population, *Schizophrenia Bulletin*, 43(6), 1280–1290.
- Cicchetti, D., Rogosch, F.A., & Cox Kearns, S. (2001). Diverse patterns of neuroendocrine activity in maltreated children. *Development and Psychopathology*, 13(3), 677–693.
- Claes, M. (1994). Friendship characteristics of adolescents referred for psychiatric treatment. *Journal of Adolescent Research*, 9, 180–192.
- Cohen, S., & Wills, T.A. (1985). Stress, social support, and the buffering hypothesis. *Psychological Bulletin*, 98(2), 310–357.
- Collip, D., Myin-Germeys, I., Wichers, M., Jacobs, N., Derom, C., Thiery, E., . . . , van Winkel, R. (2013). FKBP5 as a possible moderator of the psychosis-inducing effects of childhood trauma. *The British Journal of Psychiatry*, 202(4), 261–268.
- Collishaw, S., Pickles, A., Messer, J., Rutter, M., Shearer, C., & Maughan, B. (2007). Resilience to adult psychopathology following childhood maltreatment: Evidence from a community sample. *Child Abuse & Neglect*, 31(3), 211–229.
- Corcoran, C., Walker, E., Huot, R., Mittal, V., Tessner, K., Kestler, L., & Malaspina, D. (2003). The stress cascade and schizophrenia: Etiology and onset. *Schizophrenia Bulletin*, 29(4), 671–692.
- Cougnard, A., Marcelis, M., Myin-Germeys, I., De Graaf, R., Vollebergh, W., Krabbendam, L., . . . , van Os, J. (2007). Does normal developmental expression of psychosis combine with environmental risk to cause persistence of psychosis? A psychosis proneness-persistence model. *Psychological Medicine*, 37(4), 513–527.
- Crush, E., Arseneault, A., & Fisher, H.L. (2018c). Girls get by with a little help from their friends: Gender differences in the protective effects of social support in relation to psychotic phenomena amongst poly-victimised adolescents. *Social Psychiatry & Psychiatric Epidemiology*, doi: 10.1007/s00127-018-1599-6.
- Crush, E., Arseneault, L., Jaffee, S.R., Danese, A., & Fisher H.L. (2018a). Protective factors for psychotic symptoms among poly-victimized children. *Schizophrenia Bulletin*, 44(3), 691–700.

- Crush E., Arseneault, L., Moffitt, T.E., Danese, A., Caspi, A., Jaffee, S.R., . . . , Fisher, H.L. (2018b). Protective factors for psychotic experiences amongst adolescents exposed to multiple forms of victimization. *Journal of Psychiatric Research*, 104, 32-28.
- Curran, C., Byrappa, N., McBride, A. (2004). Stimulant psychosis: systematic review. *The British Journal of Psychiatry*, 185, 196–204.
- Danese, A., Moffitt, T.E., Arseneault, L., Bleiberg, B., Dinardo, P.B., Gandelman, S.B., . . . , Caspi, A. (2017). The origins of cognitive deficits in victimised children: implications for neuroscientists and clinicians. *American Journal of Psychiatry*, 174(4), 349-361.
- De Bellis, M.D., Chrousos, G.P., Dorn, L.D., Burke, L., Helmers, K., Kling, M.A., . . . , Putnam, F.W. (1994). Hypothalamic-pituitary-adrenal axis dysregulation in sexually abused girls. *Journal of Clinical Endocrinology and Metabolism*, 78(2), 249–255.
- DeVylder, J.E., Koyanagi, A., Unick, J., Oh, H., Nam, B., & Stickley, A. (2016). Stress sensitivity and psychotic experiences in 39 low- and middle-income countries. *Schizophrenia Bulletin*, 42(6), 1353–1362.
- Dhossche, D., Ferdinand, R., van der Ende, J., Hofstra, M., & Verhulst, F. (2002). Diagnostic outcome of self-reported hallucinations in a community sample of adolescents. *Psychological Medicine*, 32(4), 619-627.
- Dodge, K.A., Bates, J.E., & Pettit, G.S. (1990). Mechanisms in the cycle of violence. *Science*, 250, 1678-1683.
- Dong, M., Anda, R.F., Felitti, V.J., Dube, S.R., Williamson, D.F., Thompson, T.J., . . . , Giles, W.H. (2004). The interrelatedness of multiple forms of childhood abuse, neglect, and household dysfunction. *Child Abuse and Neglect*, 28(7), 771–784.
- Dube, S.R., Anda, R.F., Felitti, V.J., Chapman, D.P., Williamson, D.F., & Giles, W.H. (2001). Childhood abuse, household dysfunction, and the risk of attempted suicide throughout the life span: findings from the Adverse Childhood Experiences Study. *JAMA*, 286 (24) 3089-3096.
- Dumont, M., & Provost, M.A. (1999). Resilience in adolescents: Protective role of social support, coping strategies, self-esteem, and social activities on experience of stress and depression. *Journal of Youth and Adolescence*, 28(3), 343-363.

DuMont, K.A., Widom, C.S., & Czaja, S.J. (2007). Predictors of resilience in abused and neglected children grown-up: The role of individual and neighborhood characteristics. *Child Abuse and Neglect*, 31(3), 255–274.

Edwards, V.J., Holden, G.W., Felitti, V.J., & Anda, R.F. (2003). Relationship between multiple forms of childhood maltreatment and adult mental health in community respondents: results from the adverse childhood experiences study. *American Journal of Psychiatry*, 160(8), 1453- 1460.

Faulkes, S. (2006). *Human Traces*. New York: Vintage Books.

Felitti, V. J., Anda, R.F., Nordenberg, D., Williamson, D. F., Spitz, A. M., Edwards, V., . . . , Marks, J. S. (1998). Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults. *American Journal of Preventive Medicine*, 14(4), 245–258.

Finkelhor, D., Hamby, S.L., Turner, H.A., & Ormrod, R.K. (2011). *The Juvenile Victimization Questionnaire: 2nd Revision (JVQ-R2)*. Durham, NH: Crimes Against Children Research Center.

Finkelhor, D., Ormrod, R.K., & Turner, H.A. (2007). Poly-victimization: A neglected component in child victimization. *Child Abuse and Neglect*, 31(1), 7–26.

Firth, J., Cotter, J., Elliott, R., French, P., & Yung, A.R. (2015). A systematic review and meta-analysis of exercise interventions in schizophrenia patients. *Psychological Medicine*, 45, 1343-1361.

Fisher, H.L., Caspi, A., Moffitt, T.E., Wertz, J., Gray, R., Newbury, J., . . . , Arseneault, L. (2015). Measuring adolescents' exposure to victimization: The Environmental Risk (E-Risk) Longitudinal Twin Study. *Development and Psychopathology*, 27, 1399-1416.

Fisher, H.L., Caspi, A., Poulton, R., Meier, M.H., Houts, R., Harrington, H., . . . , Moffitt, T.E. (2013a). Specificity of childhood psychotic symptoms for predicting schizophrenia by 38 years of age: a birth cohort study. *Psychological Medicine*, 43(10), 2077–2086.

Fisher, H.L., Craig, F.P., Morgan, K., Dazzan, P., Lappin, J., Hutchinson, G., . . . , Morgan, C. (2011). Reliability and comparability of psychosis patient's retrospective reports of childhood abuse. *Schizophrenia Bulletin*, 37, 546–553.

- Fisher, H.L., Jones, P.B., Fearon, P., Craig, T.K., Dazzan, P., Morgan, K., . . . , Morgan, C. (2010). The varying impact of type, timing and frequency of exposure to childhood adversity on its association with adult psychotic disorder. *Psychological Medicine*, 40(12), 1967–1978.
- Fisher, H.L., Schreier, A., Zammit, S., Maughan, B., Munafò, M.R., Lewis, G., & Wolke, D. (2013b). Pathways between childhood victimization and psychosis-like symptoms in the ALSPAC birth cohort. *Schizophrenia Bulletin*, 39(5), 1045–1055.
- Fone, D., Dunstan, F., Lloyd, K., Williams, G., Watkins, J., & Palmer, S. (2007). Does social cohesion modify the association between area income deprivation and mental health? A multilevel analysis. *International Journal of Epidemiology*, 36(2), 338–345.
- Freeman, D., & Fowler, D. (2009). Routes to psychotic symptoms: Trauma, anxiety and psychosis-like experiences. *Psychiatry Research*, 169(2), 107–112.
- Freeman, D., Garety, P., Fowler, D., Kuipers, E., Dunn, G., Bebbington, P., & Hadley, C. (1998). The London-East Anglia randomized controlled trial of cognitive-behaviour therapy for psychosis IV: Self-esteem and persecutory delusions. *British Journal of Clinical Psychology*, 37(4), 415–430.
- Fresán, A., León-Ortiz, P., Robles-García, R., Azcárraga, M., Guizar, D., Reyes-Madriral, F., . . . , de la Fuente-Sandoval, C. (2015). Personality features in ultra-high risk for psychosis: a comparative study with schizophrenia and control subjects using the Temperament and Character Inventory-Revised (TCI-R). *Journal of Psychiatric Research*, 61, 168–173.
- Garety, P.A, Bebbington, P., Fowler, D., Freeman, D., & Kuipers, E. (2007). Implications for neurobiological research of cognitive models of psychosis: a theoretical paper. *Psychological Medicine*, 37, 1377–1391.
- Gayer-Anderson, C., Fisher, H.L., Fearon, P., Hutchinson, G., Morgan, K., Dazzan, P., . . . , Morgan, C. (2015). Gender differences in the association between childhood physical and sexual abuse, social support and psychosis. *Social Psychiatry and Psychiatric Epidemiology*, 50(10), 1489–1500.
- Gayer-Anderson, C., & Morgan, C. (2013). Social networks, support and early psychosis: a systematic review. *Epidemiology and Psychiatric Sciences*, 22(2), 131–146.
- Gerstadt, C.L., Hong, Y.J., & Diamond, A. (1994). The relationship between cognition and action: performance of children 3 ½-7 years old on a Stroop-like day-night test. *Cognition*, 53, 129–153.

- Gibson, L.E., Anglin, D.M., Klugman, J.T., Reeves, L.E., Fineberg, A.M., Maxwell, S.D., . . . , Ellman, L.M. (2014). Stress sensitivity mediates the relationship between traumatic life events and attenuated positive psychotic symptoms differentially by gender in a college population sample. *Journal of Psychiatric Research*, 53(1), 111–118.
- Gilbert, R., Widom C.S., Browne, K., Fergusson, D., Webb, E., Janson, S. (2009). Burden and consequences of child maltreatment in high-income countries. *Lancet*, 373(9657), 68-81.
- Goldsmith, H.H., & Gottesman, I.I. (1981). Origins of variation in behavioural style: a longitudinal study of temperament in young twins. *Child Development*, 52, 91–103.
- Goodman, R. (1994). A modified version of the Rutter parent questionnaire including extra items on children's strengths: a research note. *Journal of Child Psychology and Psychiatry*, 35, 1483–1494.
- Goodwin, R.D. (2003). Association between physical activity and mental disorders among adults in the United States. *Preventative Medicine*, 36(6), 698-703.
- Goodman, L.A., Thompson, K.M., Weinfurt, K., Corl, S., Acker, P., Mueser, K.T., & Rosenberg, S.D. (1999). Reliability of reports of violent victimization and posttraumatic stress disorder among men and women with serious mental illness. *Journal of Traumatic Stress*, 12(4), 587-599.
- Grodzinsky, G.M., & Diamond, R. (1992) Frontal lobe functioning in boys with attention-deficit hyperactivity disorder. *Developmental Neuropsychology*, 8, 427–445.
- Hamby, S., Finkelhor, D., Ormrod, D., & Turner, H. (2004). *The comprehensive JVQ administration and scoring manual*. Durham, NH: University of New Hampshire, Crimes Against Children Research Center.
- Hammed, M., Lingam, R., Zammit, S., Salvi, G., Sullivan, S., & Lewis, A.J. (2018). Trajectories of early childhood developmental skills and early adolescent psychotic experiences: Findings from the ALSPAC UK birth cohort. *Frontiers in Psychology*, 8, 1-11.
- Hanssen, M.S.S., Bijl, R.V., Vollebergh, W., & van Os, J. (2003). Self-reported psychotic experiences in the general population: A valid screening tool for DSM-III-R psychotic disorders? *Acta Psychiatrica Scandinavica*, 107(5), 369–377.
- Hardt, J., & Rutter, M. (2004). Validity of adult retrospective reports of adverse childhood experiences: Review of the evidence. *Journal of Child Psychology and Psychiatry*, 45(2), 260-273.

- Hardy, A., Fowler, D., Freeman, D., Smith, B., Steel, C., Evans, J., . . . , Dunn, G. (2005). Trauma and hallucinatory experience in psychosis. *The Journal of Nervous and Mental Disease*, 193(8), 501–507.
- Harrop, C., Ellett, L., Brand, R., & Lobban, F. (2015). Friends interventions in psychosis: A narrative review and call to action. *Early Intervention in Psychiatry*, 9(4), 269–278.
- Harvey, S.B., Hotopf, M., Overland, S., & Mykletun, A. (2010). Physical activity and common mental disorders. *The British Journal of Psychiatry*, 197(5), 357–64.
- Heim, C., Ehler, U., & Hellhammer, D.H. (2000). The potential role of hypocortisolism in the pathophysiology of stress-related bodily disorders. *Psychoneuroendocrinology*, 25(1), 1–35.
- Henry, B. (1999). Reliability and validity of an observational measure of early-emerging individual differences among preschool children. *Unpubl. Manuscript*. Colby Coll. Waterville, Maine.
- Herrenkohl, T.I., Lee, J., & Hawkins, J.D. (2012). Risk versus direct protective factors and youth violence: Seattle Social Development Project. *American Journal of Preventive Medicine*, 43(2), S41–S56.
- Hoekstra, R.A., Bartels, M., & Boomsma, D.I. (2007). Longitudinal genetic study of verbal and nonverbal IQ from early childhood to young adulthood. *Learning and Individual Differences*, 17(2), 97–114.
- Horwood, J., Salvi, G., Thomas, K., Duffy, L., Gunnell, D., Hollis, C., . . . , Harrison, G. (2008). IQ and non-clinical psychotic symptoms in 12-year-olds: results from the ALSPAC birth cohort. *The British Journal of Psychiatry*, 193(3), 185–191.
- Howell, K.H., & Miller-Graff, L.E. (2014). Protective factors associated with resilient functioning in young adulthood after childhood exposure to violence. *Child Abuse and Neglect*, 38(12), 1985–1994.
- Howes, O.D., & Murray, R.M. (2014). Schizophrenia: an integrated sociodevelopmental-cognitive model. *Lancet*, 383, 1677–1687.
- Howes, O., Egerton, A., Allan, V., McGuire, P., Stokes, P., & Kapur, S. (2009). Mechanisms underlying psychosis and antipsychotic treatment response in schizophrenia: Insights from PET and SPECT imaging. *Current Pharmaceutical Design*, 15(22), 2550–2559.

- Hultman, C.M., Wieselgren, I.M., & Ohman, A. (1997). Relationships between social support, social coping and life events in the relapse of schizophrenic patients. *Scandinavian Journal of Psychology*, 38(1), 3–13.
- Husted, J.A., Ahmed, R., Chow, E.W.C., Brzustowicz, L.M., & Bassett, A.S. (2010). Childhood trauma and genetic factors in familial schizophrenia associated with the NOS1AP gene. *Schizophrenia Research*, 121(1–3), 187–192.
- Ising, H.K., Veling, W., Loewy, R.L., Rietveld, M.W., Rietdijk, J., Dragt, S., . . . , van der Gaag, M. (2014). The Validity of the 16-Item Version of the Prodromal Questionnaire (PQ-16) to Screen for Ultra High Risk of Developing Psychosis in the General Help-Seeking Population. *Schizophrenia Bulletin*, 38(6), 1288–1296.
- Jaffee, S., Caspi, A., Moffitt, T.E., Polo-Tomás, M., & Taylor, A. (2007). Individual, family, and neighborhood factors distinguish resilient from non-resilient maltreated children: a cumulative stressors model. *Child Abuse & Neglect*, 31(3), 231–253.
- Jaffee, S.R., Caspi, A., Moffitt, T.E., & Taylor, A. (2004). Physical maltreatment victim to antisocial child: evidence of an environmentally mediated process. *Journal of Abnormal Child Psychology*, 113, 44–55.
- Jalbrzikowski, M., Sugar, C.A., Zinberg, J., Bachman, P., Cannon, T.D., & Bearden, C.E. (2014). Coping styles of individuals at clinical high risk for developing psychosis. *Early Intervention in Psychiatry*, 8(1), 68–76.
- Janssen, I., Krabbendam, L., Bak, M., Hanssen, M., Vollebergh, W., de Graaf, R., & van Os, J. (2004). Childhood abuse as a risk factor for psychotic experiences. *Acta Psychiatrica Scandinavica*, 109(16), 38–45.
- Johns, L.C., Cannon, M., Singleton, N., Murray, R.M., Farrell, M., Brugha, T., . . . , Meltzer, H. (2004). Prevalence and correlates of self-reported psychotic symptoms in the British population Prevalence and correlates of self-reported psychotic symptoms in the British population. *The British Journal of Psychiatry*, 185, 298–305.
- Johnson, R.M., Kotch, J.B., Catellier, D.J., Winsor, J.R., Dufort, V., Hunter, W., & Amaya-Jackson, L. (2002). Adverse behavioral and emotional outcomes from child abuse and witnessed violence. *Child Maltreatment*, 7(3), 179–186.
- Kabiru, C.W., Elung'ata, P., Mojola, S.A., & Beguy, D. (2014). Adverse life events and delinquent behavior among Kenyan adolescents: A cross-sectional study on the protective

role of parental monitoring, religiosity, and self-esteem. *Child and Adolescent Psychiatry and Mental Health*, 8(1), 1–11.

Kashdan, T.B., & Rottenberg, J. (2010). Psychological flexibility as a fundamental aspect of health. *Clinical Psychology Review*, 30(7), 865–878.

Kelleher, I., Connor, D., Clarke, M.C., Devlin, N., Harley, M., & Cannon, M. (2012a). Prevalence of psychotic symptoms in childhood and adolescence: a systematic review and meta-analysis of population-based studies. *Psychological Medicine*, 42, 1857–1863.

Kelleher, I., Harley, M., Murtagh, A., & Cannon, M. (2011). Are screening instruments valid for psychotic-like experiences? A validation study of screening questions for psychotic-like experiences using in-depth clinical interview. *Schizophrenia Bulletin*, 37(2), 362–369.

Kelleher, I., Keeley, H., Corcoran, P., Lynch, F., Fitzpatrick, C., Devlin, N., . . . , Roddy, S. (2012c). Clinicopathological significance of psychotic experiences in non-psychotic young people: Evidence from four population-based studies, *The British Journal of Psychiatry*, 201(1), 26–32.

Kelleher, I., Keeley, H., Corcoran, P., Ramsay, H., Wasserman, C., Carli, V., . . . , Cannon, M. (2013). Childhood trauma and psychosis in a prospective cohort study: Cause, effect, and directionality. *American Journal of Psychiatry*, 170(7), 734–741.

Kelleher, I., Lynch, F., Harley, M., Molloy, C., Roddy, S., Fitzpatrick, C., & Cannon, M. (2012b). Psychotic symptoms in adolescence index risk for suicidal behavior: Findings from 2 population-based case-control clinical interview studies. *Archives of General Psychiatry*, 69(12), 1277–1283.

Kelleher, I., Wigman, J.T.W., Harley, M., O’Hanlon, E., Coughlan, H., Rawdon, C., . . . , Cannon, M. (2015). Psychotic experiences in the population: Association with functioning and mental distress. *Schizophrenia Research*, 165(1), 9–14.

Kendler, K.S. (1997). Social support: A genetic-epidemiologic analysis. *American Journal of Psychiatry*, 154, 1398–1404.

Kendler, K.S., Gruenberg, A.M., & Kinney, D.K. (1994). Independent diagnoses of adoptees and relatives as defined by DSM-III in the provincial and national samples of the Danish Adoption Study of Schizophrenia. *Archives of General Psychiatry*, 51, 456–468.



- Kendler, K.S., Gallagher, T.J., Abelson, J.M., & Kessler, R.C. (1996). Lifetime prevalence, demographic risk factors, and diagnostic validity of nonaffective psychosis as assessed in a US community sample. *Archives of General Psychiatry*, 53, 1022–1031.
- Kessler, R.C., McLaughlin, K.A, Green, J.G., Gruber, M.J., Sampson, N.A, Zaslavsky, A.M., . . . , Williams, D.R. (2010). Childhood adversities and adult psychopathology in the WHO World Mental Health Surveys. *The British Journal of Psychiatry*, 197(5), 378–385.
- Kim-Cohen, J., Caspi, A., Taylor, A., Williams, B., Newcombe, R., Craig, I.W., & Moffitt, T.E. (2006). MAOA, maltreatment, and gene-environment interaction predicting children's mental health: new evidence and a meta-analysis. *Molecular Psychiatry*, 11, 903–913.
- Kirkbride, J., Errazuriz, A., Croudace, T., Morgan, C., Jackson, D., Mccrone, P., . . . , Jones, P. (2012). *Systematic review of the incidence and prevalence of schizophrenia and other psychoses in England*. London: Department of Health Policy Research Programme.
- Kommescher, M., Wagner, M., Pützfeld, V., Berning, J., Janssen, B., Decker, P., . . . , Bechdorf, A. (2016). Coping as a predictor of treatment outcome in people at clinical high risk of psychosis. *Early Intervention in Psychiatry*. 10, 17–27.
- Kovacs, M. (1992). *Children's Depression Inventory: Manual*. Toronto: Multi-Health Systems.
- Krabbendam, L., Janssen, I., Bak, M., Bijl, R. V., de Graaf, R., & van Os, J. (2002). Neuroticism and low self-esteem as risk factors for psychosis. *Social Psychiatry and Psychiatric Epidemiology*, 37(1), 1–6.
- Krabbendam, L., Myin-Germeys, I., Hanssen, M., de Graaf, R., Vollebergh, W., Bak, M., & van Os, J. (2005). Development of depressed mood predicts onset of psychotic disorder in individuals who report hallucinatory experiences. *British Journal of Clinical Psychology*, 44(1), 113–125.
- Kremen, W.S., Buka, S.L., Seidman, L.J., Goldstein, J.M., Koren, D., & Tsuang, M.T. (1998). IQ decline during childhood and adult psychotic symptoms in a community sample: A 19-year longitudinal study. *American Journal of Psychiatry*, 155, 672–677.
- Landman-Peeters, K.M.C., Hartman, C.A., van der Pompe, G., Den Boer, J.A., Minderaa, R.B., & Ormel, J. (2005). Gender differences in the relation between social support, problems in parent-offspring communication, and depression and anxiety. *Social Science and Medicine*, 60(11), 2549–2559.

- Lansford, J.E., Dodge, K.A., Pettit, G.S., Bates, J.E., Crozier, J., & Kaplow J. (2002). Long-term effects of early child physical maltreatment on psychological, behavioral, and academic problems in adolescence: a 12-year prospective study. *Archives of Pediatrics and Adolescent Medicine*, 156, 824-830.
- Lardinois, M., Lataster, T., Mengelers, R., van Os, J., & Myin-Germeys, I. (2011). Childhood trauma and increased stress sensitivity in psychosis. *Acta Psychiatrica Scandinavica*, 123(1), 28–35.
- Lee, S.H., DeCandia, T.R., Ripke, S., Yang, J., Sullivan, P.F., Goddard, M.E., . . . , Wray, N.R. (2012). Estimating the proportion of variation in susceptibility to schizophrenia captured by common SNPs. *Nature Genetics*, 44(3), 247–250.
- Leonhardt, B.L., Hamm, J.A., Belanger, E.A., & Lysaker, P.H. (2015). Childhood sexual abuse moderates the relationship of self-reflectivity with increased emotional distress in schizophrenia. *Psychosis*, 7(3), 195–205.
- Levitt, M.J., Guacci-Franco, N., & Levitt, J.L. (1993). Convoys of social support in childhood and early adolescence: Structure and function. *Developmental Psychology*, 29, 811–818.
- Lim, M.H., Gleeson, J.F.M., Alvarez-Jimenez, M., & Penn, D.L. (2018). Loneliness in psychosis: a systematic review. *Social Psychiatry and Psychiatric Epidemiology*, 53(3), 221–238.
- Linscott, R.J., & van Os, J. (2013). An updated and conservative systematic review and meta-analysis of epidemiological evidence on psychotic experiences in children and adults: on the pathway from proneness to persistence to dimensional expression across mental disorders. *Psychological Medicine*, 43, 1133–1149.
- Loewy, R.L., Pearson, R., Vinogradov, S., Bearden, C.E., & Cannon, T.D. (2011). Psychosis risk screening with the Prodromal Questionnaire—brief version (PQ-B). *Schizophrenia Research*, 129(1), 42-46.
- Luthar, S., Cicchetti, D., & Becker, B. (2000). The construct of resilience: A critical evaluation and guidelines for future work. *Child Development*, 71(3), 543–562.
- Mackie, C., Castellanos-Ryan, N., & Conrod, P.J. (2011). Developmental trajectories of psychotic-like experiences across adolescence: impact of victimization and substance use. *Psychological Medicine*, 41(1), 47-58.

- Magaña, A.B., Goldstein, J.M., Karno, M., Miklowitz, D.J., Jenkins, J., & Falloon, I.R. (1986). A brief method for assessing expressed emotion in relatives of psychiatric patients. *Psychiatry Research*, 17, 203-212.
- March, J.S., Parker, J.D., Sullivan, K., Stallings, P., & Conners, C.K. (1997). The Multidimensional Anxiety Scale for Children (MASC): Factor structure, reliability, and validity. *Journal of the American Academy of Child & Adolescent Psychiatry*, 36(4), 554-565.
- Marulanda, S., & Addington, J. (2016). Resilience in individuals at clinical high risk for psychosis. *Early Intervention in Psychiatry*, 10(3), 212-219.
- Masten, A.S. (2001). Ordinary magic: Resilience processes in development. *American Psychologist*, 56, 227–238.
- Masten, A.S., & Coatsworth, J.D. (1998). The development of competence in favorable and unfavorable environments: Lessons from research on successful children. *American Psychologist*, 53(2), 205–220.
- Masten, A.S., Hubbard, J.J., Gest, S.D., Tellegen, A., Garmezy, N., & Ramirez, M. (1999). Competence in the context of adversity: Pathways to resilience and maladaptation from childhood to late adolescence. *Development and Psychopathology*, 11(1), 143–169.
- Matthews, T., Danese, A., Wertz, J., Odgers, C.L., Ambler, A., Moffitt, T.E., & Arseneault, L. (2016). Social isolation, loneliness and depression in young adulthood: a behavioural genetic analysis. *Social Psychiatry and Psychiatric Epidemiology*, 51, 339–348.
- Mayer-Gross, W., Slater, E., & Roth, M. (1954). *Clinical Psychiatry*. London: Cassell & Co.
- Maynard, R.A. (1997). *Kids having kids: Economic costs & social consequences of teen pregnancy*. Washington, DC: The Urban Institute.
- Meng, X., Fleury, M.J., Xiang, Y.T., Li, M., & D'Arcy, C. (2018). Resilience and protective factors among people with a history of child maltreatment: a systematic review. *Social Psychiatry and Psychiatric Epidemiology*, 53, 453–475.
- McGorry, P.D., Killackey, E., & Yung, A. (2008). Early intervention in psychosis: concepts, evidence and future directions. *World Psychiatry*, 7(3), 148–156.
- McGorry, P.D., Purcell, R., Goldstone, S., & Amminger, G.P. (2011). Age of onset and timing of treatment for mental and substance use disorders: Implications for preventive intervention strategies and models of care. *Current Opinion in Psychiatry*, 24(4), 301–306.

- McGrath, J.J., Sukanta, S., Al-Hamzawi, A., Alonso, J., Bromet, E.J., Bruffaerts, R., . . . , Kessler, R.C. (2015). Psychotic experiences in the general population: A cross-national analysis based on 31 261 respondents from 18 countries. *JAMA Psychiatry*, 72, 697–705.
- Meng, X., Fleury, M. J., Tao, Y., Muzi, X., & Carl, L. (2018). Resilience and protective factors among people with a history of child maltreatment: a systematic review. *Social Psychiatry and Psychiatric Epidemiology*, 53(5), 453–475.
- Messner, S.F., Baumer, E.P., & Rosenfeld, R. (2004). Dimensions of social capital and rates of criminal homicide. *American Sociological Review*, 69(6), 882-903.
- Miller, T.J., Cicchetti, D., Markovich, P.J., McGlashan, T.H., & Woods, S.W. (2004). The SIPS-Screen: a brief self-report screen to detect the schizophrenia prodrome. *Schizophrenia Research*, 70 (suppl1), 78.
- Miller, T.J., McGlashan, T.H., Rosen, J.L., Cadenhead, K., Ventura, J., McFarlane, W., . . . , Woods, S.W. (2003). Prodromal assessment with the structured interview for prodromal syndromes and the scale of prodromal symptoms: predictive validity, interrater reliability, and training to reliability. *Schizophrenia Bulletin*, 29(4), 703.
- Milne, B., Moffitt, T., Crump, R., Poulton, R., Rutter, M., Sears, M., Taylor, A., & Caspi, A. (2008). How should we construct psychiatric family history scores? A comparison of alternative approaches from the Dunedin Family Health History Study. *Psychological Medicine*, 38(12), 1793-1802.
- Moffitt T.E., Caspi A., Krueger R.F., Magdol L., Margolin G., Silva P.A., & Sydney R. (1997) Do partners agree about abuse in their relationship? A psychometric evaluation of interpartner agreement. *Psychological Assessment*, 9(1), 47-56.
- Moffitt, T.E., & The E-Risk Study Team. (2002). Teen-aged mothers in contemporary Britain. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, 43(6), 727-742.
- Mongan, D., Shannon, C., Hanna, D., Boyd, A., & Mulholland, C. (2017). The association between specific types of childhood adversity and attenuated psychotic symptoms in a community sample. *Early Intervention in Psychiatry*, doi: 10.1111/eip.12478.
- Monroe, S.M., & Simons, A.D. (1991). Diathesis-stress theories in the context of life stress research: implications for the depressive disorders. *Psychological Bulletin*, 110(3), 406-25
- Morgan, C., & Fisher, H.L. (2007). Environment and schizophrenia: Environmental factors in schizophrenia: Childhood trauma - A critical review. *Schizophrenia Bulletin*, 33(1), 3–10.

- Morgan, C., & Gayer-Anderson, C. (2016). Childhood adversities and psychosis: evidence, challenges, implications. *World Psychiatry*, 15, 93–102.
- Morgan, C., Reininghaus, U., Reichenberg, A., Frissa, S., Hotopf, M., & Hatch, S.L. (2014). Adversity, cannabis use and psychotic experiences: Evidence of cumulative and synergistic effects. *The British Journal of Psychiatry*, 204(5), 346–353.
- Morin, F., Dhir, A., Mitchell, E., & Jones, A. (2017). Social support: A useful tool in the management of psychotic disorders. *University of British Columbia Medical Journal*, 8(2), 10–12.
- Morrison, A.P., French, P., Walford, L., Lewis, S.W., Kilcommons, A., Green, J., . . . , Bentall, R.P. (2004). Cognitive therapy for the prevention of psychosis in people at ultra-high risk: Randomised controlled trial. *The British Journal of Psychiatry*, 185(4), 291–297.
- Naslund, J.A., Aschbrenner, K.A., Marsch, L.A., & Bartels, S.J. (2016). The future of mental health care: Peer-to-peer support and social media. *Epidemiology and Psychiatric Sciences*, 25(2), 113–122.
- Newbury, J., Arseneault, L., Caspi, A., Moffitt, T.E., Odgers, C.L., & Fisher, H.L. (2016). Why are children in urban neighborhoods at increased risk for psychotic symptoms? Findings from a UK longitudinal cohort study. *Schizophrenia Bulletin*, 42(6), 1372–1383.
- Nitzburg, G.C., Gopin, C.B., Peters, B.D., Karlsgodt, K.H., Malhotra, A.K., & DeRosse P. (2016). The relationship between temperament and character and psychotic-like experiences in healthy children and adolescents. *European Psychiatry*, 31, 60–65.
- Norman, R.M.G., Malla, A.K., Manchanda, R., Harricharan, R., Takhar, J., & Northcott, S. (2005). Social support and three-year symptom and admission outcomes for first episode psychosis. *Schizophrenia Research*, 80, 227–234.
- Odgers, C.L., Caspi, A., Bates, C.J., Sampson, R.J., & Moffitt, T.E. (2012). Systematic social observation of children's neighborhoods using Google Street View: a reliable and cost-effective method. *Journal of Child Psychology and Psychiatry*, 53(10), 1009–1017.
- Odgers, C. L., Donley, S., Caspi, A., Bates, C. J., & Moffitt, T. E. (2015). Living alongside more affluent neighbors predicts greater involvement in antisocial behavior among low-income boys. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, 56(10), 1055–1064.

- Odgers, C.L., Moffitt, T.E., Tach, L.M., Sampson, R.J., Taylor, A., Matthews, C.L., & Caspi, A. (2009). The protective effects of neighborhood collective efficacy on British children growing up in deprivation: a developmental analysis. *Developmental Psychology*, 45(4), 942–957.
- Patel, V., & Goodman, A. (2007). Researching protective and promotive factors in mental health. *International Journal of Epidemiology*, 36(4), 703–707.
- Perala, J., Suvisaari, J., Saarni, S. I., Kuoppasalmi, K., Isometsa, E., Pirkola, S., . . . , Lonnqvist, J. (2007). Lifetime prevalence of psychotic and bipolar I disorders in a general population. *Archives of General Psychiatry*, 64, 19-28.
- Pérez-González, A., Guilera, G., Pereda, N., & Jarne, A. (2017). Child Abuse & Neglect Protective factors promoting resilience in the relation between child sexual victimization and internalizing and externalizing symptoms. *Child Abuse & Neglect*, 72, 393–403.
- Peters, E., Ward, T., Jackson, M., Morgan, C., Charalambides, M., McGuire, P., . . . , Garety, P.A. (2016). Clinical, socio-demographic and psychological characteristics in individuals with persistent psychotic experiences with and without a “need for care”. *World Psychiatry*, 15, 41 –52.
- Pilling, S., Bebbington, P., Kuipers, E., Garety, P., Geddes, J., Orbach, G., & Morgan, C. (2002). Psychological treatments in schizophrenia: Meta-analysis of family intervention and cognitive behaviour therapy. *Psychological Medicine*, 32, 763–782.
- Pingault, J.B., O'Reilly, P.F., Schoeler, T., Ploubidis, G.B., Rijdsdijk, F., & Dudbridge, F. (2018). Using genetic data to strengthen causal inference in observational research. *Nature Reviews Genetics*, 19, 566-580.
- Polanczyk, G., Moffitt, T.E., Arseneault, L., Cannon, M., Ambler, A., Keefe, R., . . . , Caspi, A. (2010). Etiological and clinical features of childhood psychotic symptoms. *Archives of General Psychiatry*, 67(4), 328–338.
- Pos, K., Bartels-Velthuis, A.A., Simons, C.J.P., Korver-Nieberg, N., Meijer, C.J., & De Haan, L. (2015). Theory of Mind and attachment styles in people with psychotic disorders, their siblings, and controls. *Australian and New Zealand Journal of Psychiatry*, 49(2), 171–180.
- Pos, K., Boyette, L-L., Meijer, C.J., Koeter, M., Krabbendam, L., & de Haan, L. (2016). The effect of childhood trauma and Five-Factor Model personality traits on exposure to adult life events in patients with psychotic disorders. *Cognitive Neuropsychiatry*, 21(6), 462–474.

- Poulton, R., Caspi, A., Moffitt, T.E., & Cannon, M. (2000). Children's self-reported psychotic symptoms and adult schizophreniform disorder: A 15-year longitudinal study. *Archives of General Psychiatry*, 57(11), 1053–1058.
- Power, M.J., Champion, L.A., & Aris, S.J. (1988). The development of a measure of social support: the Significant Others (SOS) Scale. *British Journal of Clinical Psychology*, 27, 349–358.
- Price, T.S., Freeman, B., Craig, I., Petrill, S.A., Ebersole, L., & Plomin, R. (2000). Infant zygosity can be assigned by parental report questionnaire data. *Twin Research and Human Genetics*, 3(3), 129–133.
- Pruessner, J., Champagne, F., Meaney, M., & Dagher, A. (2004). Dopamine release in response to a psychological stress in humans and its relationship to early life maternal care: A positron emission tomography study using [11C] raclopride. *Journal of Neuroscience*, 24(11), 2825–2831.
- Pruessner, M., Iyer, S.N., Faridi, K., Joober, R., & Malla, A.K. (2018). Stress and protective factors in individuals at ultra-high risk for psychosis, first episode psychosis and healthy controls Stress and protective factors in individuals at ultra-high risk for psychosis, first episode psychosis and healthy controls. *Schizophrenia Research*, 129(1), 29–35.
- Quiroga, A., López-Rodríguez, L., & Willis, G.B. (2017). Parental support buffering the effect of violence on adolescents' depression: Gender differences. *Journal of Interpersonal Violence*, 32(7), 1068–1086.
- Radford, L., Corral, S., Bradley, C., & Fisher, H.L. (2013). The prevalence and impact of child maltreatment and other types of victimization in the UK: findings from a population survey of caregivers, children and young people and young adults. *Child Abuse & Neglect*, 37(10), 801–813.
- Rauschenberg, C., van Os, J., Cremers, D., Goedhart, M., Schievelde, J.N.M., & Reininghaus, U. (2017). Stress sensitivity as a putative mechanism linking childhood trauma and psychopathology in youth's daily life. *Acta Psychiatrica Scandinavica*, 136, 373–388.
- Read, J., Agar, K., Argyle, N., & Aderhold, V. (2003). Sexual and physical abuse during childhood and adulthood as predictors of hallucinations, delusions and thought disorder. *Psychology and Psychotherapy: Theory, Research and Practice*, 76(1), 1–22.

- Read, J., Mosher, L., & Bentall, R.P. (2004). *Models of Madness: Psychological, Social and Biological Approaches to Schizophrenia*. Hove, UK: Brunner-Routledge.
- Read, J., van Os, J., Morrison, A.P., & Ross, C.A. (2005). Childhood trauma, psychosis and schizophrenia: A literature review with theoretical and clinical implications. *Acta Psychiatrica Scandinavica*, 112(5), 330–350.
- Reijntjes, A., Kamphuis, J.H., Prinzie, P., & Telch, M.J. (2010). Peer victimization and internalizing problems in children: A meta-analysis of longitudinal studies. *Child Abuse and Neglect*, 34(4), 244–252.
- Reininghaus, U., Valmaggia, L., Kempton, M.J., Calem, M., Onyejiaka, A., & Hubbard, K., . . . , Morgan, C. (2018). Psychological processes underlying the association between childhood trauma and psychosis in daily life: an experience sampling study. *Psychological Medicine*, 46, 2799–2813.
- Repetti, R.L., Taylor, S.E., & Seeman, T.E. (2002). Risky families: Family social environments and the mental and physical health of offspring. *Psychological Bulletin*, 128(2), 330–366.
- Riches, S., Arseneault, L., Bagher-Niakan, R., Alsultan, M., Crush, E., & Fisher, H.L. (2018). Protective factors for early psychotic phenomena among children of mothers with psychosis. *Frontiers in Psychiatry*, doi: 10.3389/fpsyt.2018.00750.
- Riggio, H.R., & Kwong, W.Y. (2011). Paranoid thinking, quality of relationships with parents, and social outcomes among young adults. *Journal of Family Issues*, 32, 1030–1049.
- Ripke, S., O'Dushlaine, C., Chambert, K., Moran, J.L., Kähler, A.K., Akterin, S., . . . , Sullivan, P.F. (2013). Genome-wide association analysis identifies 13 new risk loci for schizophrenia. *Nature Genetics*, 45(10), 1150–1159.
- Rivera, C.L., Bernal, G., & Rosello, J. (2005). The Children Depression Inventory (CDI) and the Beck Depression Inventory (BDI): Their validity as screening measures for major depression in a group of Puerto Rican adolescents. *International Journal of Clinical and Health Psychology*, 5(3), 485-498.
- Rogers, W. (1994). Regression standard errors in clustered samples. *Stata Technical Bulletin*, 3(13), 19-23.
- Rosenthal, D. (1970). *Genetic theory and abnormal behavior*. New York: McGraw-Hill.



- Rubin, C., Rubenstein, J., Stechler, G., Heeren, T., Halton, A., Housman, D., & Kasten, L. (1992). Depressive affect in “normal” adolescents: Relationship to life stress, family and friends. *American Journal of Orthopsychiatric Association*, 62(3), 430–441.
- Rueger, S.Y., Malecki, C.K., & Demaray, M.K. (2010). Relationship between multiple sources of perceived social support and psychological and academic adjustment in early adolescence: Comparisons across gender. *Journal of Youth and Adolescence*, 39(1), 47–61.
- Rutter, M. (1985). Resilience in the face of adversity. Protective factors and resistance to psychiatric disorder. *The British Journal of Psychiatry*, 147(6), 598–611.
- Rutter, M. (1987). Psychosocial resilience and protective mechanisms. *American Journal of Orthopsychiatric Association*, 57(3), 316–331.
- Rutter, M. (2006). *The promotion of resilience in the face of adversity. Families Count: Effects on Child and Adolescent Development*. Cambridge University Press: Cambridge
- Rutter, M., Moffitt, T.E., Caspi, A. (2006). Gene-environment interplay and psychopathology: multiple varieties but real effects. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, 41(3-4), 226-261.
- Sallis, J.F. (1993). Epidemiology of physical activity and fitness in children and adolescents. *Critical Reviews in Food Science and Nutrition*, 33, 403–408.
- Samplin, E., Ikuta, T., Malhotra, A.K., Szeszko, P.R., & DeRosse, P. (2013). Sex differences in resilience to childhood maltreatment: Effects of trauma history on hippocampal volume, general cognition and subclinical psychosis in healthy adults. *Journal of Psychiatric Research*, 47(9), 1174–1179.
- Sampson, R.J., Raudenbush, S.W., & Earls, F. (1997). Neighborhoods and violent crime: A multilevel study of collective efficacy. *Science*, 277, 918–924.
- Saunders, B.E. (2003). Understanding children exposed to violence: Toward an integration of overlapping fields. *Journal of Interpersonal Violence*, 18(4), 356–376.
- Sattler, J. (1992) *Assessment of Children: WISC-III and WPPSI-R Supplement*. San Diego, CA: Jerome M. Sattler, Publisher, Inc.
- Schaefer, J.D., Moffitt, T.E., Arseneault, L., Danese, A., Fisher, H.L., Houts, R., . . . , Caspi, A. (2018). Adolescent victimization and early-adult psychopathology: Approaching causal

inference using a longitudinal twin study to rule out noncausal explanations. *Clinical Psychological Science*, 6(3), 352-371.

Schreier, A., Wolke, D., Thomas, K., Horwood, J., Hollis, C., Gunnell, D., Lewis, G., Thompson, A., Zammit, S., & Duffy, L. (2009). Prospective study of peer victimisation in childhood and psychotic symptoms in a nonclinical population at age 12 years. *Archives of General Psychiatry*, 66(5), 527-536.

Schwab, S.G., & Wildenauer, D.B. (2013). Genetics of psychiatric disorders in the GWAS era: an update on schizophrenia. *European Archives of Psychiatry and Clinical Neuroscience*, 263 (Suppl 2), S147-54.

Sclare, I. (1997). *The Child Psychology Portfolio*. Windsor, Berkshire, United Kingdom: NFER-Nelson Publishing Company.

Shakoor, S., Jaffee, S.R., Andreou, P., Bowes, L., Ambler, A., Caspi, C., . . . , Arseneault, L. (2011). Mothers and children as informants of bullying victimization: results from an epidemiological cohort of children. *Journal of Abnormal Child Psychology*, 39, 379-387.

Shevlin, M., Houston, J.E., Dorahy, M.J., & Adamson, G. (2008). Cumulative traumas and psychosis: An analysis of the national comorbidity survey and the British Psychiatric Morbidity Survey. *Schizophrenia Bulletin*, 34(1), 193–199.

Singham, T., Viding, E., Schoeler, T., Arseneault, L., Ronald, A., Cecil, C.M., McCrory, E., Rijdsdijk, F., & Pingault, J-B. (2017). Concurrent and longitudinal contribution of exposure to bullying in childhood to mental health: The role of vulnerability and resilience. *The Journal of the American Medical Association*, 74(11), 1112–1119.

Smith, B.W., Dalen, J., Wiggins, K., Tooley, E., Christopher, P., & Bernard, J. (2008). The brief resilience scale: Assessing the ability to bounce back. *International Journal of Behavioral Medicine*, 15(3), 194–200.

Smith, B., Fowler, D. G., Freeman, D., Bebbington, P., Bashforth, H., Garety, P., . . . , Kuipers, E. (2006). Emotion and psychosis: links between depression, self-esteem, negative schematic beliefs and delusions and hallucinations. *Schizophrenia Research*, 86(1–3), 181–188.

Smyth, N., Siriwardhana, C., Hotopf, M., & Hatch, S.L. (2015). Social networks, social support and psychiatric symptoms: social determinants and associations within a multicultural community population. *Social Psychiatry and Psychiatric Epidemiology*, 50(7), 1111–1120.

- Sormunen, E., Saarinen, M.M., Salokangas, R.K.R., Telama, R., Hutri-Kähönen, N., Tammelin, T., . . . , Hietala, J. (2017). Effects of childhood and adolescence physical activity patterns on psychosis risk - a general population cohort study. *NPJ Schizophrenia*, 3(5), 5.
- Spauwen, J., Krabbendam, L., Lieb, R., Wittchen, H.U., & van Os, J. (2004). Does urbanicity shift the population expression of psychosis? *Journal of Psychiatric Research*, 38(6), 613-618.
- Spauwen, J., Krabbendam, L., Lieb, R., Wittchen, H.U., & van Os, J. (2006). Impact of psychological trauma on the development of psychotic symptoms: relationship with psychosis proneness. *The British Journal of Psychiatry*, 188, 527–533.
- Stanford University. (2001). *Stanford Brief Activity Survey*. Stanford University, California.
- Straus M. (1990). *Measuring intrafamily conflict and violence: the Conflict Tactics (CT) scales*. In: Straus, M.A., & Gelles, R.G. (Eds.) *Physical violence in American families: risk factors and adaptations to violence in 8,145 families* (pp.403-424). New Brunswick, NJ: Transaction Press.
- Stubbs, B., Firth, J., Berry, A., Schuch, F.B., Rosenbaum, S., Gaughran, F., . . . , Vancampfort, D. (2016). How much physical activity do people with schizophrenia engage in? A systematic review, comparative meta-analysis and meta-regression. *Schizophrenia Research*, 176(2–3), 431–440.
- Suetani, S., Mamun, A., Williams, G.M., Najman, J.M., Mcgrath, J.J., & Scott, J.G. (2017). Longitudinal association between physical activity engagement during adolescence and mental health outcomes in young adults: A 21-year birth cohort study. *Journal of Psychiatric Research*, 94, 116–123.
- Sündermann, O., Onwumere, J., Kane, F., Morgan, C., & Kuipers, E. (2014). Social networks and support in first-episode psychosis: Exploring the role of loneliness and anxiety. *Social Psychiatry and Psychiatric Epidemiology*, 49(3), 359–366.
- Tao, F.B., Xu, M.L., Kim, S.D., Sun, Y., Su, P.Y., & Huang, K. (2007). Physical activity might not be the protective factor for health risk behaviours and psychopathological symptoms in adolescents. *Journal of Paediatrics and Child Health*, 43, 762-767.
- Taylor-Piliae, R.E., Fair, J.M., Haskell, W.L., Varady, A.N., Iribarren, C., Hlatky, M.A., . . . , Fortmann, S.P. (2010). Validation of the Stanford Brief Activity Survey: examining psychological factors and physical activity levels in older adults. *Journal of Physical Activity and Health*, 7, 87–94.

- Thewissen, V., Bentall, R.P., Oorschot, M., Campo, J., van Lierop, T., van Os, J., & Myin-Germeys, I. (2011). Emotions, self-esteem, and paranoid episodes: An experience sampling study. *British Journal of Clinical Psychology*, 50(2), 178–195.
- Thompson, A., Sullivan, S., Lewis, G., Zammit, S., Heron, J., Horwood, J., . . . , Harrison, G. (2011). Association between locus of control in childhood and psychotic symptoms in early adolescence: Results from a large birth cohort. *Cognitive Neuropsychiatry*, 16(5), 385–402.
- Tidey, J.W., & Miczek, K.A. (1996). Social defeat stress selectively alters mesocorticolimbic dopamine release: an in vivo microdialysis study. *Brain Research*, 721(1–2), 140–149.
- Tienari, P., Wynne, L.C., Läksy, K., Moring, J., Nieminen, P., Sorri, A., . . . , Wahlberg, K.E. (2003). Genetic boundaries of the schizophrenia spectrum: Evidence from the Finnish adoptive family study of schizophrenia. *American Journal of Psychiatry*, 160(9), 1587–1594.
- Tienari, P., Wynne, L., Sorri, A., Lahti, I., Lakso, K., Moring, J., . . . , Wahlberg, K. (2004). Genotype-environment interaction in schizophrenia-spectrum disorder Long-term follow-up study of Finnish adoptees. *The British Journal of Psychiatry*, 184(3), 216–222.
- Trotta, A., Di Forti, M., Mondelli, V., Dazzan, P., Pariante, C., David, A., . . . , Fisher, H.L. (2013). Prevalence of bullying victimisation amongst first-episode psychosis patients and unaffected controls. *Schizophrenia Research*, 150(1), 169–175.
- Trotta, A., Murray, R.M., & Fisher, H.L. (2015). The impact of childhood adversity on the persistence of psychotic symptoms: A systematic review and meta-analysis. *Psychological Medicine*, 45(12), 2481–2498.
- Trouton, A., Spinath, F.M., & Plomin, R. (2002). Twins early development study (TEDS): A multivariate, longitudinal genetic investigation of language, cognition and behavior problems in childhood. *Twin Research*, 5(5), 444–448.
- Turner, H.A., Shattuck, A., Finkelhor, D., & Hamby, S. (2015). Effects of poly-victimization on adolescent social Support, self-Concept, and psychological distress. *Journal of Interpersonal Violence*, 32(5), 1–26.
- Trzesniewski, K.H., Moffitt, T.E., Caspi, A., Taylor, A., & Maughan, B. (2006). Revisiting the association between reading achievement and antisocial behavior: New evidence of an environmental explanation from a twin study. *Child Development*, 77(1), 72–88.

- Valtorta, N.K., Kanaan, M., Gilbody, S., & Hanratty, B. (2016). Loneliness, social isolation and social relationships: What are we measuring? A novel framework for classifying and comparing tools. *BMJ Open*, 6(4).
- van Os, J., Kenis, G., & Rutten, B.P.F. (2010). The environment and schizophrenia. *Nature*, 468, 203–212.
- van Os, J., Linscott, R. J., Myin-Germeys, I., Delespaul, P., & Krabbendam, L. (2009). A systematic review and meta-analysis of the psychosis continuum: Evidence for a psychosis proneness-persistence-impairment model of psychotic disorder. *Psychological Medicine*, 39(2), 179–195.
- van Winkel, R., Van Nierop, M., Myin-Germeys, I., & van Os, J. (2013). Childhood trauma as a cause of psychosis: Linking genes, psychology, and biology. *The Canadian Journal of Psychiatry*, 58(1), 44–51.
- Varese, F., Smeets, F., Drukker, M., Lieveise, R., Lataster, T., Viechtbauer, W., . . . , Bentall, R.P. (2012). Childhood adversities increase the risk of psychosis: a meta-analysis of patient-control, prospective- and cross-sectional cohort studies. *Schizophrenia Bulletin*, 38(4), 661–671.
- Verdoux, H., & van Os, J. (2002). Psychotic symptoms in non-clinical populations and the continuum of psychosis. *Schizophrenia Research*, 54(1–2), 59–65.
- Vitaro, F., Brendgen, M., & Arseneault, L. (2009). The discordant MZ-twin method: One step closer to the holy grail of causality. *International Journal of Behavioral Development*, 33, 376–382.
- Webster-Stratton, C. (1998). Preventing conduct problems in Head Start children: strengthening parenting competencies. *Journal of Consulting and Clinical Psychology*, 66(5), 715–730.
- Wechsler, D. (1990). *Wechsler Preschool and Primary Scale of Intelligence-Revised*. London: The Psychological Corporation, Harcourt Brace and Company.
- Wechsler, D. (2003). *Wechsler Intelligence Scale for Children - Fourth Edition*. San Antonio, TX: PsychCorp.
- Weissman, M.M., Wickramaratne, P., Adams, P., Wolk, S., Verdelli, H., & Olfson, M. (2000). Brief screening for family psychiatric history: The family history screen. *Archives of General Psychiatry*, 57(7), 675–682.

- White, J.W., Koss, M.P., & Kazdin, A.E. (2001). *Violence against women and children: Mapping the terrain*. Washington, DC: American Psychological Association.
- Wickham, S., Sitko, K., & Bentall, R.P. (2015). Insecure attachment is associated with paranoia but not hallucinations in psychotic patients: the mediating role of negative self-esteem. *Psychological Medicine*, 45, 1495–1507.
- Williams, R.L. (2000). A note on robust variance estimation for cluster-correlated data. *Biometrics*, 56, 645–646.
- World Health Organization. (2018). *The 11th Revision of the International Classification of Diseases (ICD-11)*. Geneva: World Health Organization.
- Whitfield, C.L., Dube, S.R., Felitti, V.J., & Anda, R F. (2005). Adverse childhood experiences and hallucinations. *Child Abuse and Neglect*, 29(7), 797–810.
- Winsper, C., Wolke, D., Bryson, A., Thompson, A., & Singh, S.P. (2016). School mobility during childhood predicts psychotic symptoms in late adolescence. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, 57(8), 957–966.
- Wykes, T., Reeder, C., Williams, C., Corner, J., Rice, C., & Everitt, B. (2003). Are the effects of cognitive remediation therapy (CRT) durable? Results from an exploratory trial in schizophrenia. *Schizophrenia Research*, 61, 163-174.
- Yeung, R., & Leadbeater, B. (2010). Adults make a difference: The protective effects of parent and teacher emotional support on emotional and behavioral problems of peer-victimized adolescents. *Journal of Community Psychology*, 38(1), 80–98.
- Yoshizumi, T., Murase, S., Honjo, S., Kaneko, H., & Murakami, T. (2004). Hallucinatory experiences in a community sample of Japanese children. *Journal of the American Academy of Child and Adolescent Psychiatry*, 43(8), 1030-1036.
- Yung, A.R., Nelson, B., Baker, K., Buckby, J.A., Baksheev, G., & Cosgrave, E.M. (2009). Psychotic-like experiences in a community sample of adolescents: Implications for the continuum model of psychosis and prediction of schizophrenia. *Australian and New Zealand Journal of Psychiatry*, 43(2), 118-128.
- Zammit, S., Kounali, D., Cannon, M., David, A., Gunnell, D., Heron, J., . . . , Lewis, G. (2013a). Psychotic experiences and psychotic disorders at age 18 in relation to psychotic experiences at age 12 in a longitudinal population-based cohort study. *American Journal of Psychiatry*, 170(7), 742–750.

Zammit, S., Hamshere, M.L., Dwyer, S., Georgiva, L., Timpson, N., Moskvina, V., . . . , O'Donovan, M.C. (2013b). A population-based study of genetic variation and psychotic experiences in adolescents. *Schizophrenia Bulletin*, 40(6), 1–9.

Zavos, H.M.S., Freeman, D., Haworth, C.M.A., McGuire, P., Plomin, R., Cardno, A.G., & Ronald, A. (2014). Consistent etiology of severe, frequent psychotic experiences and milder, less frequent manifestations: a twin study of specific psychotic experiences in adolescence. *JAMA Psychiatry*, 71(9), 1049–1057.

Zimet, G., Powell, S., Farley, G., Werkman, S., & Berkoff, K. (1988). Psychometric characteristics of the multidimensional scale of perceived social support. *Journal of Personality Assessment*, 55 (3), 610–617.